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THIS week's issue of Scientific Opinion completes its Third Volume, and brings the existence of this Publication, in its present form and under its original Editor, to a close. The proprietorship and conduct of Scientific Opinion have now passed into other hands, and this Journal will henceforth be incorporated with *The English Mechanic and Mirror of Science*, an illustrated weekly periodical of great popularity, and one enjoying a very large circulation.

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SCIENTIFIC OPINION.

No. 62.] WEDNESDAY, JANUARY 5, 1870. [Vol. III.

OUR PAST AND OUR FUTURE.

AT the commencement of a New Year it may not be out of place to point out to our readers what we have done in the Past and what we hope to do in the Future. This is the more necessary because since the commencement of our career we have been reticent of our own achievements; and, though we have never failed to show ourselves independent of all cliques and parties, we have also abstained from that flourish of trumpets by which some of our contemporaries were heralded, and which they even still appear with little modesty and less good taste to indulge in. But we cannot, in simple justice to ourselves and our labours, omit to refer to what we have done to establish this journal as the leading weekly representative of Science.

Let us then indicate briefly what we have attempted, toward fulfilling the scheme which we originally laid down for ourselves; and which, with more servility than exactness, has been adopted in other quarters. In the extracted articles which occupy the first part of our journal we have, to the best of our judgment, selected from all sources those papers which, from their intrinsic excellence or their relation to current theory, appeared best to represent the labours of the time. To effect this with absolute completeness would be, indeed, a Herculean task; but we trust, if we may judge from the good opinion of both English and Foreign correspondents, that our efforts have not been unattended with success. We believe that those who will cursorily glance at our original articles in the last two volumes will find among them some communications of sterling value upon every fact and discovery which has characterized the year's progress. But we have not simply been chroniclers. In our Leading Articles we have temperately, and without the influence of either persuasion or threat from interested persons, discussed all those topics of the day which relate to Science in its politico-social aspects. *Parcere subjectis, debellare superbos*, has been our guiding maxim, and we hope we have been true to it; if not, we have failed from ignorance of the necessity rather than from intention. At all events, we can honestly express our conviction that our labours in the cause of scientific education in schools and universities have borne good fruit in recent reforms, hopeless as they seemed and single-handed as they were when first accomplished. We have good reason to believe that our advocacy of reformation in State and national education has had an influence of no mean weight in obtaining the support of those in authority.

If, now, we turn to the Scientific Literature of the year, and ask, What have we done in this direction? we can safely answer that we have not been remiss. Reference to our past volumes will show that no work of value has been left unnoticed in our columns; that the reviews have not been delayed for months; and, lastly, that they have been unprejudiced, and if sometimes brief, at all events critical and judicial.

But there is a special feature which characterizes this Journal, and renders it above all others useful to the student of science—we refer to the Bibliography. In our lists of foreign scientific books will be found the title and publisher's name of every work on science published on the Continent and in England and America; and these lists are so early, that it often happens that the publication of a French scientific work is announced in these pages before it is even mentioned in the scientific journals of Paris. The Correspondence speaks for itself. We have had occasionally to admit letters we should rather have rejected; but believing that even in many cases, where unquestionable rubbish has been written, there were a few grains of truth and sense, we have preferred preserving the grain to destroying the tares and corn together. Much of our Correspondence, including communications from Darwin, Gosse, Wallace, Proctor, Sterry Hunt, David Forbes, Church, and others, contains matter of the utmost interest to men of science.

In our Reports of Societies we have given ample, comprehensive chronicles of the communications to the several learned bodies, from the Royal Society and Royal Institution to the very smallest provincial association, so that our pages, from this single aspect, present a compilation such as no other work in any language furnishes to the scientific worker. The Foreign Academies, too, have been as thoroughly represented as the irregular issue of their records permitted; our Notices include the leading learned bodies of France, Belgium, Prussia, Austria, Russia, Italy, and America; and in many cases the societies of the smaller German States have had their more important labours laid in abstract before our readers. Finally, our Notes and Memoranda, Diary, and Answers to Correspondents have given such general satisfaction that it is needless to say anything further concerning them.

Of our future we have, of course less to say. It is a blank page, on which Experience will inscribe its own tale. So far, however, as foresight can go, we have provided for it. Our communication with the continental Academies is now firmly established. Our correspondents in the chief cities already have promised us to exert themselves to keep us *au courant* of foreign scientific progress. Under the title of "The Week" we have opened a special department, in which the "news" of the week alone will find a place, and in which the gossip and *on dit* of the world of Science will be thoroughly written down for the benefit

of those who care for it. To do more justice to the increasing demands of Science we have increased the size of our Journal, and by new typographical arrangements are enabled to present our readers with printed matter which, as mere printed matter alone, is not offensive to the senses. And lastly, we have laid our plans for a more thorough and attractive series of illustrations even than those we have hitherto given.

With offers of help from all quarters, with the renewed expression of the good opinion of our old friends and the assurance of support from our new ones, and, finally, with the *mens conscia recti*,—in that we have not made vast promises and not fulfilled them, that our prospectus has not been a mere windbag, and that what we have found to do we have done with our might,—we feel confident of our future welfare as we are grateful to our early advocates for their past assistance.

THE WEEK.

WE have to record the death of two very well known and distinguished foreign men of science. M. Alex. Joachim Erdmann, one of the first of Swedish geologists, who died at the age of fifty-five; and M. Galy-Cazalat, the great French engineer, who died last week in Paris at the ripe age of seventy-seven years.

THE Dunkirk Society for the Encouragement of Sciences, offers a prize of 200f. for the best Memoir "on the Fauna of Maritime Flanders." The district included being the region embraced in the arrondissement of Dunkerque and Hazebrouck. The essayist may select either the birds, insects, or mollusks. The memoir must be sent in to the Secretary before the 1st of July, and must bear attached to it a device, and a sealed envelope with the writer's name and address, and a guarantee that the memoir has neither been published nor presented for any other prize.

A GIGANTIC aërolite is said to have fallen on the Table Mountain at the Cape of Good Hope on the 27th of November, with an explosion which was heard for a radius of twenty-five miles.

MR. JOHN STUART MILL'S work on *The Subjection of Women* has been translated into German by Professor D. A. Reyer, and is published at Graz by Pock & Company.

AMONG the candidates for the vacant Professorship of Botany in the Dublin College of Science, the old Museum of Irish Industry, are Dr. Perceval Wright, the newly-elected Professor of Botany in Trinity College; Dr. M'Nab; and Mr. Dyer, of the Royal Agricultural College, Cirencester. Dr. M'Nab is well known as an accomplished vegetable histologist.

PROFESSOR VIRCHOW delivered a lecture at the first meeting of the Berlin Anthropological Society, which was held on the 11th ult. The Professor is the President. The Vice-Presidents are Dr. Bastian, President of the German Geographical Society, and Professor Alex. Baun; the Secretaries, Professor Hartmann, Drs. Keneth and Voss; and the Treasurer, Gerichtsrath Deegen.

MR. ROBERT MALLET, the eminent engineer, has been elected a foreign correspondent in the physical class of the Royal Society of Göttingen.

OUR contemporary, the *Athenæum* does not seem happy in its selection of scientific correspondents. In Saturday's issue a gentleman named Lake alleges that he has found a vertebral column, 16 in. long, in the limestone of Cork Harbour. We can only say, like Dominie Sampson, Prodigious!

THE *Pall Mall Gazette*, in its review of Guizot's *Life of Calvin*, greatly underrates the services of the Physiologist Servetus, and mistakes the circumstances which led to his being roasted by Calvin.

A TESTIMONIAL is about to be presented to Mr. F. J. Minasi, who, owing to ill health, is about to resign the office of Secretary to the Islington Scientific Society, a post he has held for six years with credit to himself and advantage to the Society. The President heads the list of subscribers with £10, but the donation of members is limited to a guinea. Subscriptions will be received by the Librarian; the Treasurer of the fund, Mr. W. Harvey; or any member of the general committee, up to the 10th of January, 1870, when the committee will meet to settle the form of testimonial, and the mode of its presentation.

THE Report of the Medical Teachers' Association shows us that that body is deviating from the excellent outline sketched for it by its first president, Mr. J. Simon. We regret to perceive this.

AN enthusiastic but heterodox amateur astronomer, who is preparing the second edition of a scientific work for the press, asks the following question, and offers the munificent reward of two guineas for the solution of the problem which so disturbs his mind. It reminds us somewhat of Albert Smith's inimitable Mr. Scattergood:—"If all lakes, canals, rivers, and railways in the world are dead levels through their whole extent, and all of them horizontal one with another, how is this fact reconcilable with the generally received theory of the convexity of the earth's surface? By 'levels' are meant actual levels as shown by the theodolite; by 'horizontal' is meant as a table of any height is horizontal to the floor on which it stands. Partial inclines, as here and there on railways, and according to the currents in rivers, are not taken into any account."!!!

PORTRAITS of the late Jacob Bell are now ready for delivery, and may be had on application to Mr. E. Bremridge, 17, Bloomsbury-square, W.C. The engraving is by Mr. Thomas Landseer, from the painting by Sir Edwin.

"SPECULATING in a Mummy" is an interesting letter to *Land and Water* by Mr. Frank Buckland. It refers to a mummy in Jamrach's possession, and which is supposed to have a number of diamonds about it. Our readers should consult the letter for themselves.

PROFESSOR FRANKLAND reports that the samples of the Lambeth, Chelsea, and East London Companies' waters, examined by him during the last month, all contained living organisms. The Lambeth water is said to have been "very turbid and unfit for domestic use without previous filtration."

THE Chemists' ball will take place at Willis's Rooms this day fortnight.

THE first number of the American *Journal of Syphilography and Dermatology* has just appeared. It is edited by Dr. M. H. Henry.

DR. FRASER, of Edinburgh, so well known for his numerous chemico-physiological inquiries—especially on Calabar bean—has been elected an honorary member of the French Therapeutical Society.

CAMBRIDGE is determined to give scientific education to women. A committee has been formed to give lectures in Lent Term. This committee comprises Professors Adams, C. C. Babington, Cayley, Liveing, and Maurice, and about twenty gentlemen, Fellows and tutors or lecturers of their respective colleges. The lectures will comprise English history, English language and literature, Latin, Greek, German, French, algebra, and the principles of arithmetic, practical arithmetic, geometry, logic, political economy, botany, geology, and physical geography, chemistry, harmony, and thorough bass, and the theory of sound in its application to music. The fee for a single

course of lectures will be one guinea, and any women having attained the age of seventeen are eligible for attendance.

An announcement, issued with the last number of the *Illustration Horticole*, states that the editorship is to be intrusted in future to M. E. André, well known in this country in connection with Sefton Park, Liverpool, an accomplished gardener and a practised writer, but, according to the *Gardeners' Chronicle*, with less claims as a botanist than his predecessor, M. Lemaire.

Botany sustains a loss in the massacre of Dr. Maingay, at Rangoon. Dr. Maingay had been especially engaged in the examination of the Burmese flora.

The Council of the Society of Arts have decided to create a new office, that of Inspector of the Educational Department, and have selected for this appointment Mr. Critchett, who has been, for thirteen years, Assistant Secretary. The latter office will not be filled up.

At the Massachusetts Institute of Technology at Boston, we are informed—as a proof of what America is doing to educate her daughters in science—that half the laboratory tables are occupied by female students of chemistry.

Mr. J. Scott Russell has been lecturing before the Leeds Philosophical Society on "Technical Education." Judging, not from statistics, but from personal intercourse with other nations, he declares that England is decidedly inferior to France, Prussia, Switzerland, Belgium, and Holland, in education for practical pursuits.

We last week referred to the breach of faith on the part of the Science and Art Department with the Science teachers. On Monday week a meeting of the certificated teachers was held at Manchester, when it was resolved to submit to the Department of Science and Art an expression of regret and disapproval of the sudden and unanticipated mode in which that department has repudiated its engagements with the teachers, chiefly with reference to lectures.

The Rev. (?) W. Robinson writes a letter to one of the Cambridge papers of Saturday, in which he makes the following rather dangerous admission:—"Considering the manner in which the history of creation is interwoven into one of the ten commandments, and appealed to throughout the remainder of the Bible, I am constrained to admit unreservedly that unless the record in the first chapter of Genesis be a true history of creation, faith in the Bible, as a book of authority, must fall."

An amalgamation of the "Sinai" and "Palestine" Exploration Funds has taken place, and Mr. Bentley has been appointed publisher of the united *Reports*.

The *Athenæum*, in an appreciative notice of the Scandinavian *Popular Science Review*, attributes the revival of copperplate engraving in Denmark to Professor Schiödt, who is an eminent naturalist.

Recent returns from Naples confirm the idea conveyed by our recent chart of education in Europe; more than 90 per cent. of the population of Calabria are unable to read or write.

There is no longer, we believe, a hope of fusion of the Ethnological and Anthropological Societies. We believe, too, that the latter is still in pecuniary difficulties.

Among the subjects chosen for new prizes by the Highland and Agricultural Society is the "Effect of the Dry Summer of 1869 on Trees and Shrubs generally in different Soils, Situations, and Exposures."

Toxicology has lost one of its most distinguished representatives by the death of Dr. Geoghegan, of the Dublin College of Surgeons. His death was sudden.

The French Academy of Medicine has elected M. Wurtz its vice-president.

An interesting and important archæological discovery has been made at Gythio, in Lacedæmonia, consisting of a cube-fashioned stone, with five conic apertures, corresponding to the five well-known liquid Greek measures, of which hitherto all but the respective volume was known. To remove every doubt, says the *Builder*, the margin of each is inscribed with the corresponding designation.

Intelligence has been received at Venice of the total destruction of the town of Santa Maura by an earthquake at dawn on the 28th inst. No particulars are given. Corfu was not seriously injured, but at Santa Maura shocks were repeatedly experienced, and almost the whole city was destroyed. A Greek steamer has been despatched thither from Corfu with engineers, soldiers, and provisions.

Mr. Macdermott writes to the *Echo* of Monday to suggest that the best fire-escape is a solidly-constructed stone staircase. The suggestion is scientific and practical.

Dr. Lankester, active as usual, proposes that parishes should unite in erecting a common disinfecting apparatus, which he describes in detail.

A splendid meteor was seen by one of our correspondents at Southampton on this night week. It travelled from north to south.

All the evening classes, night schools, and day schools, of the South London Working Men's College reopened on Monday last, when several new classes commenced. All the classes and schools are open to women as well as men. The annual meeting of the members of the college will be held on Monday, January 10th, when Dr. Cobbold will deliver a lecture, and Sir John Lubbock will present certificates to the students who were successful at the recent examinations.

Mr. William Blanchley Rye has been appointed keeper of the printed book department in the British Museum, in the place of the late Mr. Thomas Watts.

From the report of the Chemist to the Mineral Oil Association we learn that out of seventy-five samples of petroleum purchased at different London shops, one-half were found to explode at a temperature below 100° Fahr., and therefore to come within the meaning of the term petroleum, and gave off an inflammable vapour below the lowest temperature allowed by law. Therefore, one-half of the oil ordinarily sold under the names "crystal oil," "rock oil," &c., is quite unsafe. The committee of the above Association consider this a matter urgently demanding attention. This should induce readers to obtain the apparatus described in our last.

If the Bill which Sir John Gray is preparing be made law next session, all the medical corporations in the kingdom will be practically abolished. It proposes a State examination to be held at distinct times in the three capitals.

The Allied Universities Club is an institution of which we have heard favourable reports, but of which we shall have more to say next week, *à propos* of our original scheme for a *Scientific Club*.

At a meeting of the Royal Agricultural Society of Ireland, held at Dublin on Thursday, Sir F. Arthur Knox Gore, Bart., M.P., was unanimously elected President of the Society for the ensuing year, and Lord Gough one of the Vice-Presidents for the province of Connaught.

As proof of the progress of Science-teaching in schools, we may mention that the Marlborough School has introduced a class of Physiology with most excellent results.

A new office, that of Assistant Registrar to the University of London, has been established: applications will be received till March 1st.

At a recent meeting of the Council of the Royal Botanic Society, Mr. James Decarle Sowerby, F.L.S., in consequence of

advanced age, resigned the office of Secretary; and Mr. William Sowerby, who had filled the post of Assistant Secretary for many years, was appointed to succeed him. Mr. Sowerby was one of the original founders of the Society, and was nominated Secretary in 1839 by the royal charter of incorporation. At the same meeting Mr. Thomas Don was appointed Superintendent of the Society's gardens.

The *Daily News* fails to understand why the galleries at the British Museum should be closed more frequently than the library. Our contemporary should remember that the classification and arrangement of objects of art and scientific collections, on the one hand, and of books on the other, are very different affairs. A new beast cannot be shoved into its place with the same facility as a new book.

Professor Mantegazza is elected to the new chair of Anthropology in the University of Florence.

Dr. G. Goddard Rogers has obtained the vacant Inspectorship of Public Vaccination under the medical officer of the Privy Council.

It has been resolved, at Lord Kinnaird's instance, that Greenwich time shall be telegraphed daily to all telegraph stations in England, Scotland, and Wales. All the Post Office clocks will therefore be regulated by Greenwich every morning. In Ireland, in the same way, Dublin time will be telegraphed all over the country.

ON A LUMP OF COAL.

BY PROFESSOR HUXLEY.

WHEN we in the south of England wish to speak of what is perfectly superfluous, of what is called in one of the Churches "a work of supererogation," we speak of "carrying coals to Newcastle," and I should have thought that talking about coal in Bradford really amounted to about the same thing, if it had not been that the topic of a lump of coal had been suggested to me by the council of the institute before which I now have the honour of lecturing. I have to night to endeavour to answer several questions relating to coal, and the particular coal I wish to speak about is that which, as I understand, is known in this part of the country as the better-bed coal. I imagine my hearers would be more qualified to inform me than I to instruct them on certain points regarding this substance, such as the various uses to which it is applied; but the topics on which I shall perhaps be able to give them information are such as these—what is this substance, and how and at what time was it formed? These are the questions to which I shall address myself in this lecture. The better-bed coal, as I am told—and I am indebted for this, and much other valuable information, to your excellent secretary, Mr. Miall,—forms a bed of 2 or 3 ft. in thickness, which extends over a considerable area in this part of the country; an area that I should be understating at a hundred square miles. It is to be found at various distances and depths from the surface, and its economic value is very great, its purity and freedom from sulphur rendering it absolutely invaluable in the operations of the iron-smelter. Suppose, by way of trying to find out the nature and properties of the better-bed coal, we examine the surface of any piece similar to the one before us. We shall, in the first place, notice that the block has two surfaces, an upper and lower one, which are different to the rest—smoothish and flattish. Then the opposite sides are striped and streaked, and have broken edges, which indicate the direction of the layers of the coal.

The better-bed coal, therefore, is formed of a series of indistinct layers, which are easily to be split up. If we were to examine the upper surface of the lump, we should discover that it contained a great number of little brown spots, flattish and line-like in form, resembling the edges of pieces of money; and on further examining the coal, we should find that these spots were in fact the edges of little disks resembling minute coins. These bodies are brown in hue, and differ very much in colour from the rest of the coal in which they are found. I shall speak of them as capsules, because, if they were cut across, they would be found to be hollow and to be full of some other matter. These bodies were first brought to my notice by a well-known geologist, Professor Morris, who pointed out to me that great quantities of the coal are made up of these minute capsules. Professor Morris, in a memoir written thirty years ago, gave a very good account of the form of these capsules: he showed that they had little irregular tubercles for their surface, and that on one side of each there was a three-rayed crack. This description was perfectly accurate. If we made a section of better-bed coal, and mounted it in the way microscopists are accustomed to, the coal would become transparent, and we should be able to see the structure of the capsules. On examination it would be found that each capsule was a body more or less flattened, composed of a yellow bituminous substance, and in the interior of which are a great number of minute bodies, generally rounded, but varied in shape. The material between the capsules is also composed of these little bodies, which, if magnified, are found to be little bags, either yellowish or black in hue; and it depends on their colour whether that of the coal itself is brown or black. All specimens of the better-bed coal you will find to be made up of these capsules, or of the smaller globules, and without wishing to make any general statement, I will say that so far as my investigations have yet extended, all coal of this kind possesses this structure, which is the property of a substance extremely inflammable, like resin, containing no sulphur, and leaving very little ash when burnt. These, then, are the data we have to go upon in our investigation as to the nature of the better-bed coal, and the question is, What can we make out of them?

As in all inquiries, this depends on the amount of information we can bring to the investigation; and in this case no great store of knowledge is required to make the coal give a very distinct and definite answer as to its formation. Professor Morris, thirty years ago, told us that the capsules I have referred to were the spore-cases of certain club-mosses and similar plants; not species which exist now, but which have long been extinct. This was a very sagacious suggestion, and one which has since been proved to be fully correct; but I wish to show you the steps of the proof. Starting with the discovery of the capsules, so slow was the progress of the inquiry that it took nearly thirty years to find out to what those capsules belonged. It is only four or five years since Mr. Carruthers, a very able botanist, found out these bodies in their natural position. He discovered in the coal-measures a little cone, like a fir-cone, formed, like such a cone, of a stalk from which projected a great number of leaves, and on the upper surface of these leaves were a number of bituminous bodies, which were identical with the capsules found in the coal. The capsules were here traced to their source; but the next question was—where did the coal come from? Mr. Carruthers, in honour of a teacher of his, called the cone-plant he had discovered Flemingites—not a very pretty-looking word, and a compound, in fact, of good Scotch and very dubious Greek. The Flemingites is the only plant, so far as I know, in which the capsules have been discovered in their natural position; but some plants have been discovered in the better-bed coal which are closely allied with—in fact, identical with—the Flemingites, and of one of them, the Lepidodendron, there is a magnificent specimen before me which has come from your own excellent museum. We have now, so to speak, "earthed" the capsule—we have traced it to be the product of a tree of the description of the Lepidodendron. But to what group does that tree belong? What is the nature of the capsule? And what purpose did it serve? In this matter

we can only be guided by our experience of living nature, and if we found in living nature a case of a plant of a like kind, having a similar structure and similar capsules, it would be a safe conclusion to draw that in the ancient plant the capsules served a precisely similar purpose to those of the modern one.

Well, this evidence is fortunately not far to seek, for you have on your Yorkshire moors any quantity of plants of a precisely similar character, which any one of you may examine for himself. Here is a specimen of the Lycopodium, or club-moss, and it will be seen that it is of the same character as the Lepidodendron in regard to its structure, though not in the detail, and is furnished like it with capsules. Not only so, but in the capsules of the plant found in the coal there are, as I have told you, smaller bodies, the diameter of which, when measured, as they easily can be, by the microscope, is found to be about the seven-hundredth part of an inch. Now, if I were to shake one of the branches of the present club-moss, I should get as a result a quantity of exceedingly fine powder, and an examination of the structure of that powder shows that it consists of minute bodies or spores similar to those found in the capsules of the coal. The resemblance is perfect; every peculiarity of structure that is found in the product of the ancient plant is also found in the modern one, and we have absolute proof that the Lepidodendron of the coal-measures was identical with the modern club-moss. Now, club-moss dust is used in commerce for two purposes, and, so far as I know, for two only, which do not at first sight seem to have much in common: it is used for making pills and making lightning. It is excessively resinous, and therefore dry, and repellant of water, and that is why it is used in pills. They are coated with it, so that when they have to be taken they may not be tasted: for when covered with this powder, they go down dry, whereas if they got wet, they would leave a taste in the mouth of the unfortunate individual who had to take them. That is the theory of the relation of these spores to pills; the theory of the relation of the spores to lightning is another thing. Probably you have all been to the theatre, and have been horrified by the tremendous storms and flashes of lightning that are sometimes produced there. I will let you behind the scenes a little — the club-moss powder is stage lightning. The lightning flashes of theatrical storms are produced by passing this powder through a flame; and the reason that it burns with such rapidity is that some 90 per cent. of it is a waxy, resinous matter, and as it is composed of extremely minute bodies, all of them catch fire instantaneously. If this be the nature, and these the properties, of the existing club-moss spores, there is every reason to believe—nay, there is positive proof in the close correspondence between the coal-plants, such as the Flemingites and Lepidodendron, and the Lycopodium—that the spores and capsules or spore-cases of the coal-plants had the same properties. It is clear, then, that the better-bed coal was made out of nothing more or less than the spores and spore-cases of a gigantic club-moss, and that the spores and spore-cases of that club-moss were made up of the same compressible resinous matter as those of the existing Lycopodium. Picture to yourselves a gigantic forest of these mosses, each as large as our oaks and elms, and extending for Heaven knows how many miles; each of them, in the fruiting season, covered with cones, every one of these cones made up of hundreds of leaves, each leaf covered with thirty, forty, or fifty spore-cases, and each spore-case having its thousands of spores. Imagine these great trees living and fruiting year after year, and each year shedding their cones, all laden with their burden of spores. Some of these would no doubt be carried away by the wind, others would be destroyed by insects, but another proportion would fall to the ground and accumulate there, age after age and century after century, till at length they lay in a bed of from 2 ft. to 3 ft. in thickness.

Let us further suppose that these spores were altered, as all things are altered, by the influences to which they would be subjected—that is, losing more or less of their oxygen and their hydrogen, and retaining more and more of carbon, until in fact they were changed into the better-bed coal. That, then, was the immediate origin of the better-bed coal, but it was only the immediate origin. There yet remains the question —where did all this mass of woody matter, of which the coal is formed, come from? And here again we can only go back to the analogy of existing nature. The question resolves itself into this—What is the use of the spores? What became of them? Let us consider what became of the spores of the existing Lycopodium; not the species of which I have shown you a specimen, but a kind of the spores of which it has been found possible to trace the history. Supposing that two of the spores of this plant—one of which was as small as those I have described, and the other ten times as large—dropped into a proper situation, in a moist, marshy soil, what became of them? Each of the spores was occupied by a quantity of a substance which has of late acquired an unnecessary notoriety by the name of "protoplasm"—the essence of life, of which there is something in every living creature. The spores, in fact, are the agencies for the growth of the Lycopodium; they are not exactly seeds, but partake rather of the nature of buds, containing the germ of new plants, and are detached from the parent stem for the production of them. Every one of the billions of millions of spores in the better-bed coal had in it a particle of protoplasmic substance, which possessed the power, under proper conditions, of producing another tree. That was the purpose of the spores, but out of the millions of spores which were got rid of in the way I have mentioned by a single tree of Lepidodendron or Flemingites, perhaps only two or three fulfilled the possibilities that were in it; the rest went to the accumulation that ultimately formed the better-bed coal. But under what circumstances did this formation take place? At present, as I have said, the better-bed coal lies at various depths below the surface. It must be quite obvious to you that if the better-bed coal were the accumulation of the spores of such plants as the Lycopodium now found on the moors, that plant whenever it did grow, could not have grown, like a mole, underground. But if it did not, what followed? Why, that this bed, the depth of which is from 100 to 600 ft. below the surface of the earth, must at one time have been on the surface, and all the immense accumulations of matter that are now over it could not at that time have existed. More than that, the nature of the substances which are now under and over the better-bed coal give infallible indications of the state of the earth at the time of its formation. In the diagram we see a section of the strata of the district, and that underneath the better-bed coal is a layer of clay, of exquisite fineness, and of great usefulness in the manufacture of pottery. Above the coal is about 105 ft. of clayey shales. Now, clay is hard mud —neither more nor less than the washings of the surface of the earth, carried down and deposited by water; and where the clay is very fine, you may be sure the water that deposited it had been very tranquil, and had not disturbed the clay after its deposit. Further, you may be certain that where clay was deposited, the surface had at one time been covered with water. This clay contained the roots or *stigmaria* of a plant which is known to you as Sigillaria. But the spores which composed the better-bed coal were not Sigillaria-spores. Something, therefore, must have taken place to get rid of the Sigillaria, and to convert the whole region into a place for the quiet deposit of these Lepidodendron spores. After that change there followed another, in which water must have run over the deposit that is now the better-bed coal; for in the clayey shales which form the bed next above this coal are found abundant remains of fishes and other creatures which are known to be fresh-water animals. These facts are certain, and if any of you are inclined to dispute them, there is no indirect evidence that you can bring that would be of the slightest possible value. The fact that a certain book was written by a certain person is of no value

whatever to affect the clear, unbroken evidence of these physical conditions. Above the shales is the black-bed coal, containing a great amount of vegetable matter, which is different from that of the better-bed coal. We are compelled to the conclusion that after all that immense accumulation of a hundred feet of shale, there was a stand-still, and then a formation of dry land, the growth of a forest containing ferns, Calamites—a plant identical with the common "horse-tail" of to-day — Sigillaria, and great trees resembling our cypresses and firs. How long this lasted it would be hard to say; but all this was but a fragment of the history of the coal-measures. There is positive evidence that after this forest had grown and decayed the surface began to sink again, and there were fresh formations until at last something over two thousand feet, speaking very much within the mark, of deposits were accumulated over the better-bed coal. What is the meaning of this in reference to time? There is no reason to think that the vegetation of the Lepidodendron and other trees of that epoch went on one particle faster than the vegetation of the present day. There is positive evidence that the deposit of sand and shale did not then take place by other agencies or any faster than it does at present, so that this gigantic accumulation of strata is the record of time that could not be turned precisely into years or centuries, but which might be *approximately* converted into years or centuries.

If any one were to look at the Great Pyramid, he could not say exactly how long a time was occupied in the building of it, but he might with perfect certainty say that it was not built in a day, or in a year. It is just the same with the coal-measures: the maximum time of their formation cannot be fixed, but the minimum may be fixed with certainty. I am speaking a very long way within the limit when I say it is impossible to suppose that the coal-measures accumulated faster than at the rate of $\frac{1}{10}$th of an in. in a year. 2,000 ft. are equal to 24,000 in., and that multiplied by ten gives 240,000 years. I am speaking with excessive moderation when I fix that time as the minimum for the formation of the coal-measures. Then that was but a fragment of geological time. After the coal-measures came many gigantic strata, and you might multiply the figure of years I have given by almost any factor you like to get an approximate estimate—for that is all you can get—of the time that has elapsed since those spore-cases dropped from their parent trees, and the spores were aggregated together to form the better-bed coal.

Looking at that formation, one can hardly help being struck with the prodigality of Nature. We find her erecting an elaborate series of structures, apparently with but one object in view — namely, to secure the continuance of the Lepidodendron, and having constructed these, she threw them abroad by millions of cart-loads, and didn't seem to care if one in a million, or one in twenty millions, performed the functions for which all were intended. You might say this was the prodigality and wastefulness of Nature. She accumulated these deposits—she sent them into the bowels of the earth, as I might show if I had unlimited time at my disposal, as she had—she brought them to the surface again—she played all manner of pranks with them. A great number of ages passed, and she had still no return for this investment of hers—no interest on her large capital embarked in club-mosses. She sent them down to the bottom of the earth, and they remained without purpose there: she put them into the sea, and they did no service there, for no sea-beast would have anything to do with them: finally, she brought them to the surface again in England, and there many ages passed, and still they were of no good. Julius Cæsar came and dealt with us, some two thousand years since, as we deal with the New Zealanders now: he came, bringing with him what were called the blessings of civilization, which means the extermination, as far as possible, of the people you come to civilize. Not that Cæsar exterminated us by any means; it was rather the other way. In his time, the primitive Yorkshireman, blue with woad—and, if the weather was anything like what it is at present, blue from another cause—wandered about this part of the country, and possibly found out that if this substance was mixed with sticks and set fire to, it would cook his food, and give warmth to his body. I will assume that Nature had at last been clever enough to construct a creature who could make some use of the store she had laid up so long since; she was beginning to have some little interest for her capital. Time passed, and we grew to be the great people we were in the days of Elizabeth, and still nothing more was done with the treasure. At last, in the eighteenth century, came James Watt, out of whose brain came the steam-engine; and out of that grew the innumerable branches of modern industry, some of which have made Yorkshire the great manufacturing county it is. All your industry, wealth, and activity hang on, and are the result of, the prodigal hiding by Nature of those neglected products of so many millions of years ago. And Nature is cleverer than most speculators, for she not only gets her interest in the shape of the manufacturing and commercial power of England, but she also gets back her principal. The carbonic acid gas, the ammonia, the watery vapour, and the ash, which are produced every time that coal is burnt, are precisely what Nature put into those Lepidodendron spores to start with.[1]—*A Lecture delivered before the Philosophical Society of Bradford, on Tuesday, December 28th.*

THE SPECTROSCOPE AND AURORA BOREALIS.

BY DANIEL KNODE WINDER.

In a report of the proceedings of the Royal Astronomical Society, published in May last, there is a record of several interesting observations, concerning the spectrum lines of Aurora, which it is interesting to compare with several observations made on this side of the Atlantic Ocean. These observations promise to be useful in aiding us to detetmine the nature of the Northern Light.

In the report alluded to, Mr. Plumber tells us that in the spectrum of Aurora, he saw one bright line in the green, near E.

Mr. Angström saw it as one bright line in the yellow, near D, and several faint bands, near F.

Mr. Struve observed one bright line near D, and traces of two others in the green.

Professor Winlock has seen six lines, the brightest of which was near E.

The writer has frequently seen one bright line in the yellow, near D (coincident with one of a group of lines which appear in the solar spectrum, when the sun is near the horizon), and one faint line in the green. On one occasion there was visible one additional line in the red.

It has always proved a difficult task to determine, with certainty, the position of the spectrum lines of Aurora, and as the value of observations with the spectroscope rests principally upon our ability to do so, I am glad to find that the locations of eight lines have been announced.

The wave length of M. Angström's bright line is 556·7.

The lines seen by Mr. Winlock, he determines, micrometrically to be as follows: the bright line 1,474, the other five lines, 1,280, 1,400, 1,550, 1,680, 2,640, Kirchhoff's scale.

The bright line seen by myself I found to be very nearly 557.

Now, we learn from these observations—first, that the light of Aurora gives a spectrum consisting of bright lines; secondly, that the same number of lines are not always seen; thirdly, that the lines are fixed in their positions; fourthly, that the same line is not always the brightest; lastly, that one line in

[1] It is only just to Professor Huxley to state that this report, furnished by a shorthand reporter, has not had the benefit of his revision.—Ed. *S. O.*

the spectrum of Aurora is coincident with a dark line, which appears in the solar spectrum, when the sun is near the horizon.

I was much pleased to find in No. 15, current volume, *Scientific American*, an interesting letter from Professor Vander Weyde, criticising the conclusions reached by M. Angström, and also those resulting from my own observations. To the objections which he urges against my hypothesis I will reply briefly, and I trust in the same kind spirit which he has shown in his criticism.

First, he objects because the spectrum seen by me is different from the spectrum of oxygen.

I reply, that this is a weighty objection to the opinion I have expressed, that Polar light is principally incandescent oxygen. But I have been led to this conclusion from the coincidence of the bright line in Aurora with a line in solar light, which I think it probable is produced by oxygen, because of the density of that gas. The difference between the spectrum of oxygen and that of Aurora does not seem necessarily to prove my opinion incorrect, for it is a well-known fact that the spectra of elements vary according to the circumstances under which they are produced. For illustration, potassium usually gives a spectrum of only three of the seventeen lines of which it is known to consist. Again, the position of the hydrogen line F, in the spectrum of Sirius, is changed by the movement of the star, as it recedes from the earth. Again, carbon gives six differing spectra, according to the circumstances under which they are produced, and in these the same line is not always the brightest.

Secondly, Professor Vander Weyde objects, because of the presence of a line in the spectrum that has not been identified. I confess that I am at a loss to comprehend this argument, as I have only expressed the opinion that auroral light is principally, not exclusively, incandescent oxygen.

Lastly, he objects to my explanation of the change of the bright line to a black one. I reply, that I accept the common theory, explaining the change of solar lines from bright to dark ones; I never for a moment doubted it; but the line under consideration is not an ordinary solar line, but one that is seen only when the sun is near the horizon, and therefore seems to require a different explanation, and as it is not seen at midday, I conclude that it is darkened by absorption in its passage (morning and evening) through the earth's atmosphere.

I am happy to find so many distinguished scientific gentlemen interested in the subject of the nature of Aurora borealis, and I entertain a hope that the observations made before the present season of auroral displays shall have passed away, will enable us to explain more fully the nature of its phenomena.—*Scientific American.*

ON THE DIFFERENT METHODS OF MEASURING MICROSCOPICAL OBJECTS.

MEMOIR BY COUNT A. F. CASTRACANE D' ANTELMINELLI.

IN TWO PARTS.—PART I.

IT is not only to those who contemplate the immensity of the celestial bodies, or the wonderful harmony of the stars and of their movements, that it is given to feel themselves transported with amazement when reflecting on the infinite wisdom of the Creator. The earth and the sea, under whatever aspect they are regarded, and even in most minute details, give evident proof that all proceeds from the same infinite, ordaining Mind. Or rather, all that proceeds from the hands of the highest Artificer cannot but be equally stupendous in itself, so that man feels himself compelled to marvel more when he reflects on the organization of the most humble flower of the field, or on the structure of the smallest fly, than he does at the sight of an aged oak, or at the immense bulk of an elephant. Hence, we can safely say that there is no more ineffable or purer pleasure than that which is afforded to him who, with the aid of the microscope, investigates the marvels of minute structure, so eminently calculated to exalt the mind to the admiration of Infinite Creative Wisdom.

However, the micrographical observer does not have the gratuitous enjoyment of his satisfaction, since he has very often to encounter difficulties which must be overcome, and has inevitable annoyances to bear. Among other things, the microscopist, and especially one who attends to the study of the Diatomaceæ, finds himself constantly obliged to take and to register the measures of the objects which he has before his eyes, and to calculate the minuteness of details, which are often so small that more than a thousand could be contained in the space of a millimètre.

For taking these measures, and computing the wonderful smallness of these particles, numerous are the means at the disposal of the student, who, with different methods and by different ways, can attain his desired object with more or less facility and exactitude; and of these I intend to treat. On such a subject I do not pretend to say anything new; I shall only rewrite, in a few words, as much as I have been able to collect from the best treatises which have been written on the subject; I shall, however, speak from experiments made by myself, to which I have united a few practical particulars which from time to time I have ascertained to be the most useful. I hope, however, it will not be altogether useless to make known the means I make use of, thus, as it were, clearing the way for those who wish to undertake similar researches, or who wish to be become expert in the use of the microscope.

From the first moment when I undertook the study of the Diatomaceæ, I was induced to occupy myself with their measurement as one of the data which might serve for the determination of the species, and for the identification of the subjects which I had under my eyes, with the species described in Smith's *Synopsis of the British Diatomaceæ*, and in the works of Kützing, Rabenhorst, and others. The easiest system for taking such measurements is that founded on the use of the camera lucida, an invention which is due to the celebrated English *savant*, Wollaston, in 1807, which has been successively modified and perfected by the illustrious German anatomist Soemering, the French opticians Chevallier and Nachet, and the Italian Professor John Baptist Amici, whose name is connected with nearly all the improvements in the microscope.

The camera lucida consists essentially of a reflecting surface, which forms an angle of forty-five degrees with the axis of the microscope, which surface must be such as to permit the simultaneous view of the object disposed in the field of the instrument, and of the plane on which the same image is reflected. It is, then, extremely easy for any one whose hand is trained to the use of the pencil, to draw, by these means, the object under observation, following all the contours, and making, as it were, a tracing. Sometimes, however, he finds some difficulty in seeing with ease, at the same time, the reflected image, the contour already drawn, and the point of the pencil which is completing the drawing. This inconvenience arises from the want of a just relation between the illumination of the field of the microscope and that of the plane on which he is drawing. Thus, if the former is very much illuminated and the paper in shade, it will be difficult to have a simultaneous view of the object and of the drawing he is making. Such an inconvenience must be carefully obviated by diminishing the concentration of the light in the field, or by selecting a position in which the plane on which the drawing is being made will be better illuminated.

Having completed by this method the drawing of the object, or simply indicated the extremities, the application of a metrical measure will immediately give the dimensions, increased precisely in proportion to the magnifying power used in the

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microscope; from which it results that the real size of the object is equal to the apparent size divided by the magnifying power, in diameters. It is, however, essential to remember, that in order to obtain with the camera lucida a drawing corresponding in dimensions to the increase obtained in the field of vision, the distance from the reflecting point to the plane in which the drawing is being made must be precisely equal to the distance from the same point of the object under observation; while the drawing and the measure which is deduced from it will be greater or smaller than the dimensions presented by the object in the field of the instrument, in proportion as the height of the camera lucida from the plane of the drawing may be greater or less than is correct.

Such is the most prompt and most practical method of determining the dimensions of objects which are observed under the microscope. Still, such a determination is a thing of very little importance, if not even a mere matter of curiosity. The same cannot be said, on the other hand, of the number of striæ, or rows of dots, or of cells, which may occupy a given space on the surface of the observed object. Although up to the present time those who are engaged in observing the Diatomaceæ are not agreed in recognizing the importance of such a datum in regard to the value it may have as a diagnostic character, yet it is generally acknowledged that, at any rate, within certain limits of variableness, the number of the striæ which cover the valve of a Diatomaceæ, is one of the means of identification of the species to which it belongs. It is, however, useless to trust to the means of the camera lucida for determining the thickness of the striæ, so close together and so fine are they; for this purpose it is necessary to have recourse to means of much more exquisite delicacy.

A process answering better for this purpose is found in the use of the eyepiece micrometer, which is nothing but a measure adjusted to the eyepiece, from which measure is determined the value, in relation to the magnifying power used by means of a millimètre cut on glass, and divided into hundredths and placed under the objective. The commonest form is that of a thin plate of glass, on which is engraved a series of equal divisions, and in order to facilitate the reading every fifth and tenth mark is longer than the others. Such divisions fixed in the focus of the eyepiece are seen across the field of the microscope, in such a manner as to see contemporaneously and with the greatest fineness and distinctness the object which it is wished to measure, and the divisions. Let us suppose that the object has transverse lines, of which we wish to know the intervals, in order to deduce what number would be required to occupy the space of a millimètre. To obtain this I arrange the object under the eyepiece micrometer, in such a manner that the striæ may be parallel to the divisions of the micrometer, and by causing one of the divisions to be superimposed, and to coincide with one of the striæ, I determine how many of them there are in the space of one or more of the divisions, taking notice that the observation will be nearer to the truth in proportion as it extends over a greater number of divisions. Knowing the value of the ocular divisions in relation to the magnifying power used, with a very simple equation we obtain the number of the striæ in the object corresponding to one millimètre.—*Paper read before the Quekett Club, Nov. 26th.*

The Physiology of Crime.—A very able paper on the question of the inherited tendency to crime appears in the current number of the *Journal of Mental Science*, by Mr. J. B. Thomson. The author arrives at these conclusions:—1. That crime being hereditary in the criminal class, measures are called for to break up the *caste* and community of the class. 2. That transportation and long sentences of habitual criminals are called for in order to lessen the criminal offenders. 3. That old offenders can scarcely be reclaimed, and that juveniles brought under very early training are the most hopeful; but even these are apt to lapse into their hereditary tendency. 4. That crime is so nearly allied to insanity as to be chiefly a psychological study.

SOME OF THE DIFFICULTIES OF PHOTOGRAPHY IN COLOURS.

BY M. CAREY LEA.

A VERY curious instance of two persons working in the same direction at the same time unknown to each other is that of M. Ducos du Hauron and M. Cros. The description by M. Cros of his process appeared in the journal of the Abbé Moigno, *Les Mondes*, exactly two days after the date of the patent issued to M. Ducos du Hauron for his process. But it would seem that whilst the idea hit upon by both these gentlemen was extremely ingenious, it was scarcely of a sufficiently practical nature to be patented. Starting upon the basis that all colours may be produced by the admixture in due proportions of some two or the whole three of these, viz., red, blue, and green (taking the red of an orange shade, so that it may, by dilution, give a yellow, and the blue of a blue-purple), they propose first to analyze the colours of all natural objects into these components, and then to recompose the original colours. Then views of any group of objects are taken upon paper sensitized with bromide of silver. In one of the exposures a green glass is interposed, in another a red, in the other a purple. Then a transparent carbon print is taken with each of these negatives. With the negative taken when a red glass was interposed in front of the objective, a red carbon print is taken, with the blue a blue, &c. Then, when these three prints are superposed, the combination produces a picture in all the natural colours. Ingenious as this idea undoubtedly is, the difficulties in the way of execution are evidently extremely great, and these difficulties are not merely of manipulation, but there exist very great defects of principle.

Let us suppose, for example, that one of the negatives has been taken with the interposition of a coloured glass; then it is evident that to get the colours correctly represented there is only one exact intensity proper for *each* of the other negatives. How is this to be hit? There is not the faintest indication to be had, nor is it possible that one should be found. The operator can only go on and hope for the best, and if he does hit the correct exposure for the other two negatives, it will require a great deal of cleverness and a great deal of luck.

But to obtain a full measure of the difficulties in the way, it must be observed that a very large proportion of the coloured objects which present themselves do not express themselves photographically by means of these colours, but by means of the white light which they also send back. The fact is one that I have before strongly urged upon the notice of photographers, and it becomes in the present case of great importance. An object, for example, which should send to the camera red rays only could certainly not be expected to impress itself upon a film of bromide of silver. It is the surface-light—which in the case of almost (but not quite) all substances is white—which enables such substances to impress the sensitive silver film. This fact, that coloured substances send back also white light, is rendered conspicuously evident by observing the effect of coloured light upon such substances.

For example: when the sun's rays fall directly upon the stained glass in a church window, there are produced bright patches of coloured light. These, in falling upon any coloured surface, always produce an effect of colour corresponding with the glass through which they pass. If, for example, a green patch of light fall upon a red surface, the effect is still green, not red. If the red surface did not reflect white surface-light, this result could not be produced, and the green light falling upon the red surface would be altogether extinguished. The proof is even more striking when the coloured light falls upon a black surface, as, for example, a black stuff. Here, also, a distinct colouration is always visible; it is faint, and naturally so, but the red beam is reflected back pale red, and the green pale green, and this can only be so by virtue of the white light, which even a black object returns to us a surface-light independent of its colour; and it is exactly this white surface-light

that enables these substances to impress themselves upon the photographic film.

It follows inevitably that the amount of impression which these non-actinic colours are capable of making depends, not upon their intensity of colour, but upon the amount of white light which they reflect. And this is a serious, if not a fatal, objection to the process of M. Ducos du Hauron. The relative intensity of the colours of objects in his pictures obtained through the red and the green glasses will not depend upon the relative intensity of the colours of the object (as ought to be the case for a correct representation), but upon the quantity of white light which they respectively return.—*British Journal of Photography.*

ON THE STRUCTURE OF A LIGNITE FROM THE OLD RED SANDSTONE.

BY W. R. M'NAB, M.D. EDINBURGH.

I AM indebted to Mrs. Miller for the opportunity of examining the sections of the Old Red Sandstone Lignite from Cromarty, the description of which I now wish to bring forward. On the four slides are preserved six sections, two transverse, two longitudinal, and two tangential. These sections are described and figured in Mr. Miller's works; but, although the slides were examined by the late Mr. Nicol, as well as by Mr. Miller, their peculiar characters seem to have beeen entirely overlooked. It is in the longitudinal section, parallel to the medullary rays, that the peculiar punctated markings to which I wish to direct attention, are observable. Mr. Nicol failed to detect these punctations, and, therefore, could not give any opinion as to the nature of the wood, while Mr. Miller described what he called "stippled" markings. The transverse and tangential sections are quite correctly described and figured by Mr. Miller. Judging from the figures in Mr. Miller's works, the sections must all have been examined with a low power, and it is only by the use of a power of more than 200 diameters that the peculiar structure can be easily made out. The specimen from which the slices were cut is now in the Edinburgh Museum of Science and Art, in Mr. Miller's Collection. It consists of a nodule about 6 in. by 4 in., with a black band in the centre. There can be no doubt whatever that the specimen is from the Old Red Sandstone, as Mr. Miller describes scales of certain Old Red Sandstone fish occurring in the same nodule. The nodule was collected by the late Mr. Miller himself at Cromarty, and is described in several of his books.

The transverse section exhibits no trace of annual rings, but the structure agrees with that of the Coniferæ, in there being no large openings, all the cells being of very nearly the same size. As the stem has been greatly compressed, the cells are more or less flattened. The longitudinal sections exhibit at certain parts peculiar punctated disks. The external disk is slightly oval, closely resembling the circular disks of the ordinary conifers, but the central dot is replaced by an elliptical opening, exactly the same as the peculiar central markings found in the punctated tissue of the Cycadaceæ. The long axis of the central opening corresponds to the long axis of the external disk. These markings are 5-6000ths by 3-6000ths external diameter; the central elliptical opening being nearly 4-6000ths long, and 1-6000th broad. They seem to be smaller than the ordinary coniferous punctations, and, as in the sections, they are only to be seen with great clearness in one place, it is not to be wondered at that they had escaped observation. The tangential section shows the medullary rays cut across. In the transverse section, the medullary rays can also be seen very clearly.

There can be no doubt whatever that the specimen is from the Old Red Sandstone formation; and from an examination of a large series of Lignites, from the north of Scotland, in the collection of C. W. Peach, Esq., they do not seem to be uncommon in that formation. All the specimens examined present the same external characters as the Lignite found by Mr. Miller. The microscopical structure of the other Lignites has not yet been made out, but as Mr. Peach has very kindly given me fragments of the Lignites in his collection, I hope to be able to examine and describe their microscopical structure at some future time. A considerable quantity of bituminous matter obscures, to a certain extent, some of the structure, but not enough to prevent the structure being satisfactorily made out.

What are the relations of this Lignite from the Old Red Sandstone? The disks are cycadaceous, but the structure of the rest of the stem precludes the idea of their stem being cycadaceous. The transverse section shows a very much closer relationship to the Coniferæ; but, as far as I know, all the Coniferæ, with the exception of Salisburia, have circular dots in the punctated tissue. The peculiar form of the punctated markings indicates also a rather close resemblance to scalariform tissue—an almost intermediate step between scalariform tissue and true punctated tissue. The presence of medullary rays, the uniform size of the cells, as seen on transverse section, and the presence of punctations, although they are peculiar, seem all to point to a close relation to the Coniferæ. As I cannot refer the Lignite to the carboniferous genera, Dadoxylon, or Dictyoxylon, it seems possible that it will have to be referred to a new genus; if so, I would venture to suggest the name of *Palæopitys Millerii*, for the Old Red Sandstone Lignite now described. The relation of the markings found in the Lignite to those of Salisburia is of peculiar interest. The Salisburia is known to have leaves very closely resembling those of certain ferns. May it not turn out that some of the so-called fern-like leaves from the older formations should be referred to plants resembling the Salisburia of the present day?

Murchison states that plants from the Old Red Sandstone of Caithness, examined by Professor Quekett, exhibited a true coniferous structure, allied to Araucaria. The Lignites from Caithness, examined by Quekett, are therefore quite distinct from the Lignite of Cromarty, discovered by Mr. Miller.—*The Farmer.*

WHAT A LOCAL MUSEUM SHOULD BE.

BY PROFESSOR WYVILLE THOMPSON.

THE uses of local and central museums, their best mode of arrangement, and the way in which their objects may be best displayed for the purposes of public instruction, is a subject which has of late engaged considerable attention, especially in connection with the proposal to remove the great national collection from the centre of London, and to rearrange it at Kensington. In considering this subject the first question is, What is the intention of a museum? What object is it meant to serve? A natural history museum is clearly intended as a means of instruction in natural history. It is also certainly in some of its aspects intended to be subservient to the pursuit of pleasure; but to the director of a museum that object is secondary. The opprobrium of natural science is the accumulation of technical terms. Every one of the objects, living and dead, of which the science treats must have a name before we can speak of it, or make ourselves intelligible to others when we wish to explain its nature; and every distinguishable part of it must have a name to enable us to discuss its structure and function. There are multitudes of books on natural history full of detailed descriptions, and often admirably illustrated with plates or woodcuts. These books, doubtless, give a great deal of information on all points required, and are most instructive when the reader has acquired a sufficient practical knowledge either of the things themselves or of nearly allied things, by looking at them,

handling them, and if possible, by pulling them to pieces; to understand the description fully, in the sense that the sentences become mere symbols, suggestive of images which previous practical instruction has enabled the mind to form. Still, you never can thoroughly learn an object from books; you can scarcely learn to remember its name. Imagine for a moment what a task it would be to commit to memory a list of subscribers to an hospital in Liverpool, men whose names you never heard before, and with whom you have no association of any kind. How difficult, even, it would be to remember the names of the ladies at a drawing-room, although here you are aided by descriptions of their dresses. On the other hand, how absolutely easy it is to remember the names of men to whom we are introduced, and with whom we have had even five minutes' conversation. With many people, and I should think particularly with naturalists, the names of these men become indelibly impressed upon the memory, and at any period in after life they can recall them, and with them their appearance and the circumstances under which they were encountered. You never forget the names of your acquaintances—make, then, natural objects your acquaintances, and you will have no difficulty in remembering their names. A museum is one of the places—not the best place—where such knowledge is to be acquired. It would be better if you could see your new acquaintances in their own homes, in the sea, on the rock, or in the green wood—they are more like themselves there; but there are many things which you cannot see in this way, whole groups of objects without seeing which you cannot have a good general knowledge of natural history. Besides, they may be arranged in museums, side by side, in such a way as to exhibit their natural relations, and, which is of more value than all, they may be correctly ticketed with their names, and used to verify the determination of others of the same kind from descriptions and figures.

I have not time at present to speak at length of great central or national museums. A country such as Great Britain should possess a central institution in which, besides a perfect type-collection for general instruction, there ought to be, so far as possible, everything. All the objects should be arranged systematically, and according to the most generally received classification; and each should be named, as far as possible, authoritatively, if possible, by its describer. The national museum should, in fact, be a universal court of final appeal in all cases of questionable identity, where a species may be at once brought face to face with its type. In a local museum any attempt to do anything of this kind is impossible. Miscellaneous objects would accumulate beyond the control of any local staff who could be brought to bear upon them, and beyond any reasonable limit of space. The only question is the principle on which the collections in local museums ought to be limited, and the objects selected. In a large provincial community there are two distinct classes who are interested in a natural-history collection—those who desire or who are obliged to acquire a knowledge of the principles of natural science, as bearing upon their business or professions, and those who, as amateurs, are studying practically some branch of the natural history of the locality. Both of these classes, however, go so far together, it is very desirable that both should be well grounded in general principles—in a general knowledge of form, structure, and classification.

We shall take zoology as an example. As you are well aware, the animal is divided into certain sub-kingdoms; and the principle which we keep in view as far as possible in defining these sub-kingdoms is, that each shall contain forms which are more nearly allied to one another than to anything which is outside their group. This same principle is applied to the construction of the smaller groups—classes, orders, and genera. Each of the sub-kingdoms represents a certain plan of structure which is common to all the creatures contained in that sub-kingdom. For instance, the first sub-kingdom are the vertebrata, and all its members are associated by the common character of having backbones. There are six sub-kingdoms, and it is clear that a man would have a much better general knowledge of zoology if he were to study carefully one characteristic example from each of these, than if he were to study six vertebrates or six shell-fish. The same applies to the minor groups. A man will have a much better idea of the sub-kingdom vertebrata if he study a well-marked mammal, a bird, a reptile, an amphibian, and a fish, than if he study five birds. A student taking zoology as one of his branches of professional study, can scarcely be expected to do more than familiarize himself thoroughly with the characters of the classes, and with the orders and leading families of one or two of these, and this is also about the amount of general knowledge which should be acquired by an amateur who takes up the details of a single department. The great educational object of a museum is to assist the student in acquiring this amount of knowledge, and for this purpose one important part of a local museum should be what is called a type-collection. A series of characteristic species illustrative of the leading divisions of the animal kingdom; the sub-kingdoms, classes, and orders, carefully named, arranged according to the best principles of classification, and exhibited so as to bring out as clearly as possible their relations. But there is another most important function of a local museum, and the way in which this is performed makes all the difference in the eyes of a worker between a museum worth looking at and one which is not. A local museum ought to contain a complete collection of the natural products of the neighbourhood, properly arranged and carefully marked with their localities, and, if possible, named. A naturalist is working at a particular department of the British fauna—imagine what an immense advantage it is to him to see in a local museum a series illustrating everything connected with the distribution of his group for a whole province. Suppose there were good local collections in the hands of intelligent field clubs in all the large towns, what a complete knowledge we should shortly gain of all the phenomena connected with the distribution of animal life in the country. Again, almost every locality possesses some peculiar advantages for the study of some special point. A local museum should thus consist of two departments:—1. A type-collection for the purposes of general instruction. 2. A local collection as complete as possible in every department.—*Opening Address of the United Belfast Natural History Societies.*

ON THE INFLUENCE OF SNAKE POISON WHEN APPLIED TO UNWOUNDED SURFACES.

BY DR. FAYRER.

THE following experiments are recorded by Dr. Fayrer in the *Indian Medical Gazette*, and are of great physiological interest:—

Experiment No. 1.

September 11th, 1869.—Some poison was taken from a cobra (teturiah keauteah), and about a drop inserted between the eyelids of a pariah dog at 2.58 p.m.

3 p.m.—The eye is already much irritated; lachrymation profuse. The dog keeps rubbing it with his paw, and resting the side of the head against the wall; he is very restless and uneasy; chemosis rapidly increasing. 3.5.—Lying down; rubbing the eye, which is much chemosed; whining and restless. 3.16.—Dog very restless; lies with his head resting against the wall. 3.28.—Eye intensely swollen; the animal is very restless, and whines. 3.35.—He is evidently under the influence of the poison; breathing deeply. 4.4.—Lying quiet; breathing very deep. 4.11.—Lies curled up. 4.16.—Gets up; is quite intelligent; is very weak, and cannot stand long; the eye is intensely swollen, with a pale chemosis. 5.15 p.m.—On

being roused from a lethargic state, appears stupid and confused; eye intensely swollen; lies down again, and sleeps soundly. 5.31.—Breathing slowly and heavily. 6. p.m.—Sleeping comfortably. 9.30.—Walks without difficulty; looks more natural; rubs the swollen eye with his fore-paw. The constitutional effects of the poison are evidently passing off.

12th September, 3 a.m.—Sleeping comfortably; breathing natural. 8 a.m.—Swelling of eyelids diminishing; appears lively. 5 p.m.—Still improving. 13th.—Improving; opens the eyelids; the cornea is quite opaque, and there is a muco-purulent discharge from the eye. 14th.—The dog is recovering. 15th.—Except that the cornea is opaque, and some conjunctivitis remains, the dog is well; he is cheerful; takes his food well.

It was evident in this case that the dog was poisoned by absorption from the conjunctiva. The constitutional effects were not severe as in the former dog, but the local mischief was very serious, and for a time, at all events, has destroyed the sight of that eye. The intense chemosis, no doubt, caused the corneal mischief. The results of these experiments show how careful we should be to protect the eyes when handling and approaching the cobra or viper in an excited state, when it is possible that some of the poison, scattered as the snake attempts to strike, might accidentally be injected into the eye. In another experiment a very minute portion of the poison was thus thrown into the eye of one of the gentlemen assisting in the experiments. The poison had been applied to a dog's nostril, and in the sneeze that resulted the accident happened. The eye was immediately washed and fomented, care being taken not to rub it, and no evil result beyond lachrymation, irritation, and transitory redness followed.

Experiment No. 2.

Some poison was taken from a spectacled cobra (gokurah), and a drop or two inserted into a pariah dog's nostril at 3 p.m Violent sneezing and profuse watery discharge from the nostril resulted almost immediately.

3.30.—The sneezing and watery discharge continue, and seem to irritate the dog considerably. 3.45.—No constitutional effects of the poison manifested, but the local symptoms continue unabated. Two drops more of the same poison were well rubbed into the palate. 4.15.—No change. Two more drops rubbed into the mucous surface of the cheek. 4.25.—Not affected. The last applications appear to have caused no irritation. 5 p.m.—No change. 12th September, 3 a.m.—Does not appear to be affected in any way by the poison. The catarrhal symptoms have passed away. 13th.—The dog is well.

In this case, beyond the local irritation, no effect was produced.

Experiment No. 3.

A drop of cobra-poison was inserted into a fowl's eye at 3.15 p.m.

3.18—Eye already much swollen; membrana nictitans deeply chemosed. 3.30.—Eyelids quite closed; no constitutional sign of poisoning. 3.37—No change. 4.10.—Another drop inserted into the same eye. Much irritation immediately followed; the fowl is constantly trying to scratch the eyelid with its foot. 4.20.—Beginning to droop; nodding its head; sleeping as fowls do when they begin to feel the influence of poison. 4.30.—Head more drooping. 5. No further change; no worse. 5.30.—Eyelids greatly swollen, but no appearance of any constitutional action of the poison. 9 p.m.—The same. The fowl continued to improve. The eyelids and conjunctiva became less swollen, and gradually recovered; and, on the 16th, the bird was perfectly well, and its eye quite bright again.

In this case also, as in that of the dog, the local symptoms were very severe, whilst the constitutional symptoms were mild and transient. They equally showed that the poison can be absorbed through the unbroken surface of a membrane, and that the conjunctiva especially is apt to permit of the endosmosis.

Experiment No. 4.

A few drops of cobra-poison were rubbed into the mucous lining of a fowl's mouth at 3.42 p.m. 4.15.—No effect; no sign of either local or constitutional disturbance. 12th, 8 a.m.—Not affected. 13th.—The fowl is perfectly well, and does not appear to have been in the least affected by the poison.

In this case, as in the experiments on fowls and other animals, no evil resulted from the contact of the poison with the tongue and mucous surface of the mouth.

The evidence of these four experiments is not absolutely conclusive as to the extent to which the poison may operate by absorption through a mucous membrane. They prove that absorption in the case of the conjunctiva and the Schneiderian membrane really does occur, whilst in the mouth absolutely no effect was produced. But the poison was not taken from fresh or vigorous snakes, that is, they had been some time in confinement, and its action may have been impaired. Sufficient, however, is shown to prove how dangerous the contact of the poison with the delicate mucous surface may really prove.

INSIDE A BALLOON.

THE handsome illustration on page 14 represents the interior of the celebrated French balloon "L'Union." The balloon lies upon the ground, and within it are seen M. Tissandier, with pencil and paper, making a sketch of a somewhat novel situation, and M. de Fonvielle standing up, giving instructions to have a hole which he has just discovered caulked up, if we may use the expression. M. Fonvielle thus describes the sensations experienced on entering into the interior of the balloon:—"We pass into the aërial car: the temperature is suffocating, and the thermometer marks 33° Centigrade, although in the external air it stands at 25°. This fact is not surprising when we remember that the translucent material of the balloon acts like glass, and while it allows the rays of heat to pass through it, does not permit them to travel out again. Seen from within, the balloon has a very singular appearance. It is a vast dome oscillating with every movement of the air. The light which travels through its walls is soft and toned, and the shadows of persons outside are projected on it somewhat like the figures in a magic lantern."—*Voyages Aériens.* Paris: Hachette.

The Candle-tree in Australia.—Dr. Schomburgk, Director of the Botanic Gardens, South Australia, writes as follows:—I have at last secured and received per mail from Mr. W. Bull, F.L.S., F.G.S., in London, a packet of the celebrated Candle-tree (*Parmentiera cerifera*) of Panama. If I succeed in growing the seed and acclimatising the plants, it will probably prove an introduction of importance. This tree is confined to the valley of the river Chagres, Isthmus of Panama, and was discovered in 1866, and introduced by Dr. Seemann to England. He says:—"'On entering a Forest of these trees, a person might almost fancy himself transported into a chandler's shop. From all the stems and lower branches of these trees hang long cylindrical fruits, of a yellow wax colour, so much resembling a candle as to give rise to the popular appellation, 'palo de velas' (candle-tree). The fruit is generally from two to three, but not unfrequently four feet long, and about an inch in diameter. It has opposite bifoliated leaves and large white blossoms, which, in its native habitat are grown throughout the year, but are in the greatest abundance during the rainy season. Previously, only one species of *Parmentiera pendulus* was known to exist, the fruit of which, called 'quamxilotte,' is eaten by the Mexicans, while that of *Parmentiera cerifera* serves for food to the numerous herds and cattle." Dr. Schomburgk believes there is little probability of success in the open air, except in the moisture of a tropical climate, but in conservatories, where there are the requisite appliances, there will be no difficulty in getting the plants to grow.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

THE RELATION BETWEEN THE PHYSICAL FORCES AND THE PHENOMENA OF VITALITY.

BY C. STANILAND WAKE, F.A.S.L.

IN TWO PARTS.—PART I.

AT the present moment, the hypothesis of a vital force is either quietly ignored or openly condemned by nearly all scientific men of eminence. Professor Helmholtz, in his remarkable memoir on "The History and Development of Physical Science in Modern Times," lately read before the German Scientific and Medical Association at Innsbruck, after treating of the doctrine of the "conservation of force," declared that "its application to physiology is especially important." "According to our present knowledge," says Helmholtz, "living bodies derive their energy from external nature, exactly as steam-engines do. They make use of chemical forces, affinities of the combustible carbon, and of the oxygen of the atmosphere. They are as much subjected to the law of the conservation of force as inorganic nature." Professor Helmholtz certainly supposes the *possibility* of "something else of an imponderable character," besides the physical forces being active in living bodies. That he does not, however, consider this *probable*, is evident from the fact that, in investigating the operations of sensation, we have to deal, according to his opinion with nothing but "the laws of motion." In fact, the advocates of the hypothesis of evolution, as worked out by Mr. Herbert Spencer, must necessarily deny the existence of a vital force; even as they must accept the notion of "spontaneous generation," in relation to which Professor Huxley says:—"While admitting that there is experimental evidence in its favour, Professor Haeckel denies the possibility of disproving it, and points out that the assumption that it has occurred is a necessary part of the doctrine of evolution."[1]

In the presence of such authorities as these, it is dangerous to express an opinion in support of a doctrine so completely condemned, if not disproved. This, however, has not prevented Dr. Lionel Beale from still insisting on the existence of a force, the phenomena resulting from the operation of which are so characteristic as to exclude it from the series of physical forces, and to authorize us in terming it *vital*. The grounds for the belief in the existence of this special force are thus stated:—"In all living beings there exists matter in a peculiar state which we call *living*. This living matter manifests phenomena which are different from any phenomena proved to be due to the operation of any known laws. It moves in a manner which cannot be explained by physics. Changes are effected in its composition which cannot be accounted for, and various substances are formed by it which may exhibit structure, properties, and a capacity for acting, in a manner which is peculiar to living beings, and cannot be imitated artificially, or satisfactorily explained. It takes up non-living matter in solution, and communicates its wonderful properties to it. Having increased to a certain size, the mass of living matter divides into smaller portions, every one of which possesses the same properties as the parent mass, and in equal degree."[2] The peculiar opportunities Dr. Beale has had of studying the phenomena of vitality in its primitive phase, give weight to his arguments, and it may be safely said that the vital force will yet retain its place until *formed material* can be artificially resolved into the *germinal matter* from which it is produced. But, however conclusive Dr. Beale's reasoning in favour of a vital force may be, the assertion that this power is "totally distinct from any forces or properties of which we are cognizant, and not in any way correlated with any known forms or modes of force of which we have any experience,"[3] must much weaken the argument in the eyes of the physicist. When he sees that living bodies "make use of chemical forces, affinities of the combustible carbon, and of the oxygen of the atmosphere," he will not believe but that vitality is somehow related to the energy of the ordinary forces of nature. And the physicist is not far wrong, notwithstanding that the vital force truly exists; even as Dr. Beale is on the whole correct, although that force is not so totally distinct from the physical forces as he asserts.

This statement may appear somewhat paradoxical, but its truth is not difficult of proof. The force which Dr. Beale declares to be truly vital resides in the organic matter which it vitalizes, and when this matter has passed out of its germinal phase and become formed material, it is supposed, in the very process, to lose the vital force with which it had been previously endowed. On the other hand, it is not pretended that the physical forces can ordinarily give rise to vital phenomena *directly*. Before these can show themselves, matter in a special state, which hence is called *organic*, is required, and it is the organic matter which exhibits the phenomena of vitality. Even if it were admitted that organisms can be spontaneously generated by the operation of the ordinary forces, such forces would by the act lose their ordinary character, and become truly vital, as giving vitality to an organism. But the conditions under which what is called "spontaneous generation" has been observed sufficiently rebut the notion that any such process really takes place. The presence of matter already organized is absolutely essential to the success of the experiment, and it is simply impossible to prove that the "generated" organisms were not derived from this matter itself. The boiling test is useless, as a heat which is not sufficient to destroy the organic character or "potentiality" of the fluid, cannot be sufficient to destroy the organic molecules, to the presence of which that character is due. In corroboration of this assertion I may remark that I have obtained, by infusion, living fibres, not only from *soot*, but also from the *ash* of coal that has been thoroughly burnt. Moreover, *invisibility* of organic germs is no test whatever of their absence. So far as we know, they may be but little larger than the ultimate atoms of matter themselves. Every increase in the power of the microscope, indeed, reveals forms of life unperceived. In fact, as already mentioned, Professor Haeckel admits that there is no "experimental evidence" in favour of the doctrine of spontaneous generation, although "the assumption that it has occurred is a necessary part of the doctrine of evolution." The *organism*, then, we may safely say is, now at least, essential to the exhibition of the phenomena of vitality, or to the special action of the physical forces supposed to give rise to these phenomena; and in it really centres the dispute between Dr. Beale and his opponents. It is, in fact, the existence of the organism which has to be explained, and it is as impossible to prove that the action of the physical forces could originate organized matter in the absence of preceding matter in an organic state, as it is to prove that the physical forces acting in organic matter could not display all the phenomena of vitality.[4]

[1] *The Academy*, No. 1 p. 13. [2] *Protoplasm*, p. 89.

[3] *Protoplasm*, p. 92.

[4] We must distinctly protest against the writer's assumption that there is any "vital" difference between what he calls germinal and formed matter. We confidently assert that no such difference has ever been established. The distinction is purely hypothetical.—ED. *S. O.*

Difference of Time between the Beat of the Heart and the Pulse at the Wrist.—M. Groux, the man with a fissured sternum, by the aid of a Chronograph, has ascertained that there is a perceptible difference in time between the beat of the heart and the pulse at the wrist, the time occupied being 235,000 of a second. This fact, says a contemporary, furnishes data that may be of great value in detecting aneurisms in some of the large arteries. We [Ed. *S.O.*] may remark that the interval has always been recognized, and that we imagine it is much greater than that recorded here.

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GERMAN.

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Chemismus der Pflanzenzelle. Von Prof. H. Karsten. Wien. Braumüller.
Das kaiserlich königliche montanistische Museum und die Freunde der Naturwissenchaften in Wien in den Jahren 1840-50. Von Ritter von Haidinger. Wien. Braumüller.
Die Syphilis des Gehirnes und seiner Hüllen. Von C. Rittershausen. Berlin. Preuss.
Ichthyologische Notizen (VIII. and IX.) Von Dr. F. Steindachner. Wien. Gerold's Sohn.
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Lehrbuch der Ohrenheilkunde. Von Dr. J. Gruber. Wien. Gerold's Sohn.
Lehrbuch der pathologischen Zootomie der Hausthiere. Von Prof. A. Bruckmüller. 6ste Lieferung. Wien. Braumüller.
Leitfaden für die qualitative chemische Analyse unorganischer Körper. Von Prof. G. Städeler. Zürich. Orell.
Studien aus dem Institute für experimentelle Pathologie in Wien aus dem Jahre 1869. Herausgegeben von S. Stricker. 1tes Heft. Wien. Braumüller.
Studien über die Wanderblöcke und die Diluvialgebilde Russlands. Von G. Helmersen. St. Petersburg. Leipzig. Voss.
Ueber die Bedeutung der Entwickelungsgeschichte für die Auffassung der organischen Natur. Von Prof. W. His. Leipzig. Vogel.
Ueber die Bedeutung von ferruminare und adplumbare in den Pandekten. Von Prof. A. Göppert. Breslau. Gosohorsky.
Ueber die Kresylpurpursäure. Von Dr. E. Sommaruga. Wien. Gerold's Sohn.
Würtembergische naturwissenchaftliche Jahreshefte. Herausgegeben von Professoren von Mohl, Fehling und Fraas. 25ster Jahrgang 1869. Stuttgart. Ebner.
Zur Geschichte der Syphilis. Von Dr. R. Finckenstein. Breslau. Morgenstern.

The New Rooms of the Victoria Institute.—In response to an appeal recently issued by the Council, liberal contributions have been made to enable them to hire and furnish suitable premises at No. 8, Adelphi-terrace, Strand, which are to be opened with the new year as offices, library, and reading-room, for the use of the members and associates. Valuable contributions of books have already been made, and others are promised, and it is intended to obtain a supply of leading literary and scientific periodicals. The future meetings of the Institute, on the first and third Monday evenings in the month, will be held in the new premises; which, it is hoped will form a convenient rendezvous for members visiting the metropolis.

REVIEWS OF BOOKS.

Microscopic Objects Figured and Described. By J. H. Martin, Secretary to the Mid-Kent Natural History Society. London: Van Voorst. 1870. Part I.

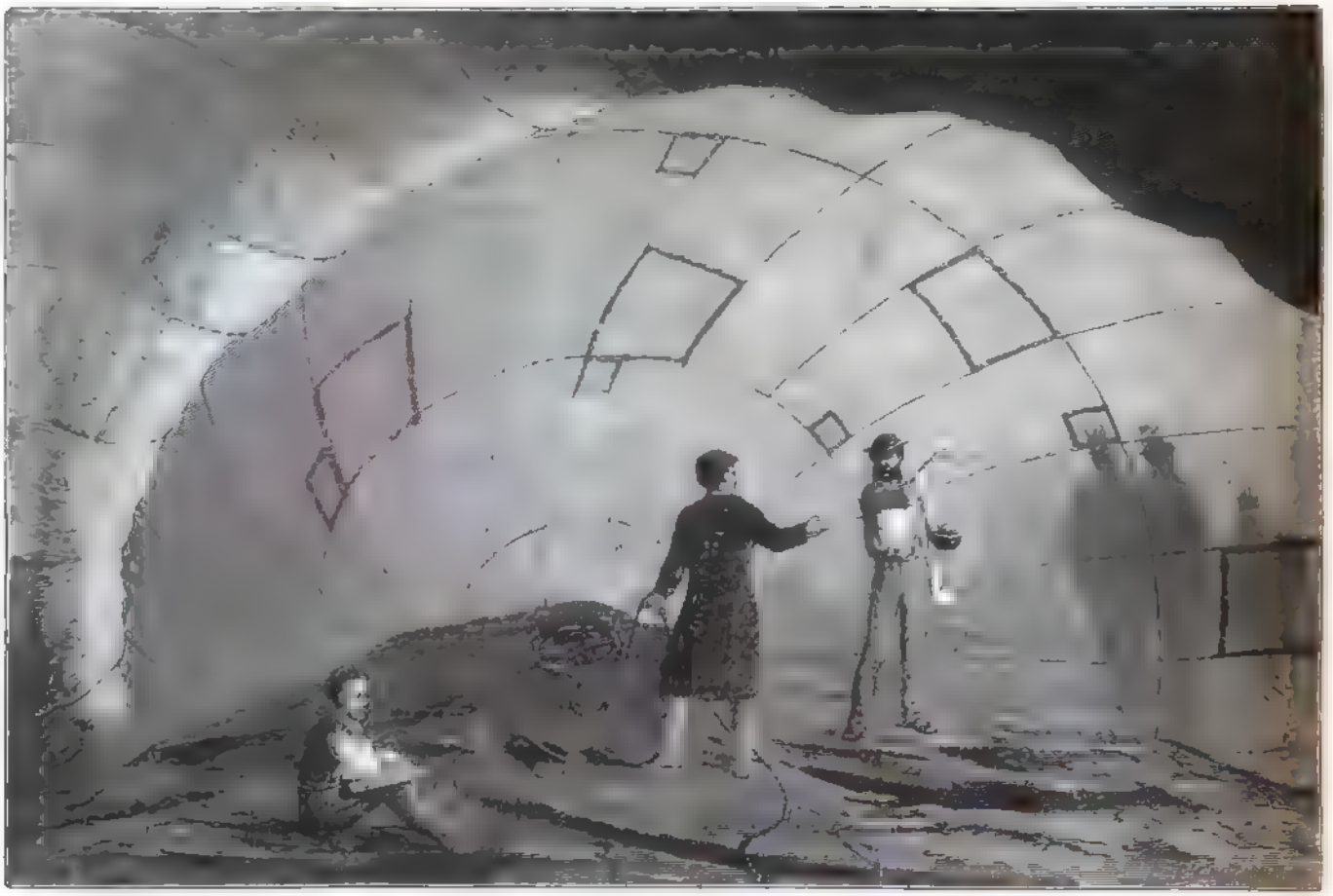
THE first part of this work, whose intended publication we noticed recently in "The Week," has now appeared, and it behoves us to say a word or two about it. It consists of a wrapper, eight pages of letter-press, and eight plates. On the latter are in all sixteen "microscope-fields," if we may coin an expression. Each field is just all that is seen under the power employed in the case in point, and is of course limited by a circle. Opposite each two "fields" is their description, the number of diameters of amplification being clearly stated. So far the plan is good, and very useful for purposes of reference. The text is also clear and terse. But the plates are not exactly what we expected. They have an amateur roughness about them which, we fear, will be detrimental to the commercial interests of the work. We ourselves do not object to them on this account, for we know very well that most of the handsome figures in microscopic works are what photographers tell us of enlargements, "touched up." Indeed, often so "touched up" that they are an artistic generalization from hosts of specimens. Mr. Martin's drawings look honest and life-like, if they lack beauty, and we give them our praise. In some places the outline wants more definition, but on the whole we prefer them to many others that we have seen. In this "Part" vegetable tissues are dealt with; they are all common forms, and all save those of the yeast-plant are good. When we have seen a few more examples of the author's handiwork, we shall be better able to predicate as to the value of his labours.

Earth and Sea. From the French of Louis Figuier. Translated, Edited, and Enlarged by W. H. Davenport Adams. London: Nelson & Sons. 1870.

WE cannot find fault with M. Figuier for the narrowness of his subject. Earth and Sea constitute a fine area for the reflections of the philosopher; and though we cannot rank M. Figuier in the latter category, we cannot deny either that he has amassed a considerable knowledge of natural phenomena, and has done a good deal towards what his countrymen would call the *vulgarization* of Science. It is, however, more as a work on physical geography than as a general treatise on biology that the editor offers this book to the public, and so far as we can see, the work meets a want. With the exception of the classic volumes of Lyell, we know of no elaborate and well-illustrated work in our language on physical geography—if there be such a science,—and we think, therefore, that this volume, which Mr. Adams has been at some pains to correct and enlarge, will obtain a favourable reception at the hands of amateur readers. It is essentially a popular and not a technical scientific essay.

The author adopts the plan of dividing his work into six books, each of which includes several chapters, and completes a particular branch of the subject. Thus Book I. deals with the situation of the terrestrial globe in space, and gives ample details of the different efforts of geographers and astronomers to describe the nature of the earth's movements, and to establish the now well-known laws of the earth's relation to other heavenly bodies. Book II. treats of the discovery of the form and dimensions of the earth, and in this we find one of the clearest popular accounts that we have yet seen of a problem very difficult to explain intelligibly to young people.

In Book III. we have an account of the surface or general contour of the globe, of the great mountains and valleys, table-lands and plains, and deserts of the earth; how they originated, and what forces are now operating to alter or destroy them. This portion of the work is indeed a well-prepared



INSIDE A BALLOON. [See p. 11.

digest of the principles of physical geology. Book IV. embraces a discussion of the different theories as to terrestrial heat, and also to the solar heat and climate. Under this heading, too, comes the description of glaciers and their influences, earthquakes, and volcanoes. The lakes and rivers—all fresh waters—are comprised in Book V.; and lastly, in Book VI., we have a sketch of the chief seas and oceans, and an account of the sea-bed and its contents, and of the principal apparatus employed in sounding.

The illustrations to this work are especially good, and they are as numerous as they are effective. As a sample we beg to refer our readers to the artistic sketch on page 15 of this journal, in which a number of Arabs are represented sinking a well. In connection with this illustration, which seems perhaps unimportant scientifically, it is necessary to state that Arab well-sinking is a very different thing from European well-sinking. The Arab knows no way of removing the water as he works, and consequently the work is done by divers, who frequently labour under the tremendous pressure of a column of water 150 ft. in height. In conclusion, we would remark that, if the editors of M. Figuier's other treatises had been as earnest and conscientious in discharging their task as Mr. Adams has been, we should have less fault to find with "adaptations from the French," and our English readers would receive something besides mere gaudy pictures, which, in some of the earlier of M. Figuier's books, are all that is to be found. Our thanks are therefore due to the editor, and indeed not less to the publishers, for this very handsomely executed and accurate and useful volume.

Cups and their Customs. Second Edition. London: Van Voorst. 1869.

IF antiquarian pursuits, as they were carried on some ten or fifteen years ago, can be called a science, then this little volume which Mr. van Voorst has issued is a scientific one. At all events, those who are interested in the history of the goblet should run through its pages, where they will find much ancient lore to interest and please them. The frontispiece, representing an antique glass cup with a sprig of borage, is extremely pretty, and will make the mouths of *connoisseur* collectors water. If Luther be right, and "Wein, Weiber und Gesang" hold so important a rank in worldly affairs, assuredly *Cups and their Customs* is not without its value.

Vargasia. Boletin de la Sociedad Ciencias Fisicas y Naturales de Caracas, 1869. No. V.

WHO would think of finding in an out-of-the-way place like Venezuela anything scientific! and yet there is in Caracas an excellent scientific body, some of whose leading members pay us the esteemed compliment of being readers of SCIENTIFIC OPINION. We have now before us the last Bulletin of the Physical and Natural Sciences Society of Caracas, and

ARABS SINKING A WELL. [See p. 14.

we are bound to say that in every respect it is more like a copy of the *Proceedings* of some Metropolitan Society than a Report of so distant a "body" as that which it represents. Its contents are numerous, but the following papers are among the most important:—"On *Clavo dicotomica*," by A. Ernst. "A Visit to the Caves of Peñon," by S. Ugarte; "The Analysis of a Local Mineral;" "On *Ursus nasutris*," by A. Ernst; "Geological Notices on the Auriferous District of Caratal," by Dr. leNeve Foster; and lastly, an excellent paper, accompanied by a very handsome plate, on an Excursion, by M. A. Goering, to the Caves of Guácharo, in the Valley of Caripe. We congratulate the Caracas Society on the great usefulness of its labours, and we trust that in future we shall receive its communications more regularly.

Geological Report of the Exploration of the Yellowstone and Missouri Rivers. By Dr. F. V. Hayden. Washington: Government Printing Office. 1869.

THIS is a most valuable addition to the history of American geology, and is, indeed, in other respects a most interesting volume, of which we hope soon to reproduce some portion for the benefit of our readers. It is accompanied by a very large coloured map (4 ft. by 3 ft.) of the geology of the

district described, and contains copious lists of the minerals and fossils discovered. The appendix is especially important to palæontologists. It embraces an account of the Cretaceous and Tertiary plants, by Dr. J. S. Newberry, Professor of Palæontology of the School of Mines, Columbia College, New York, and deals with nearly fifty species.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

THE PROBABLE SEAT OF VOLCANIC ACTION.—*From* PROFESSOR STERRY HUNT.

SIR,—In SCIENTIFIC OPINION for October 27th (p. 456), the Rev. Ormerod Fisher refers to a suggestion made by him in the *Geological Magazine* for November, 1868, that a diminution of pressure consequent on movements in the earth's crust might cause rocks highly heated, but maintained in a solid state by great pressure, to pass into a condition of liquidity. Mr. Scrope, in the succeeding number of that magazine, asserted that this view had been advanced by him in the two successive editions of his work on Volcanos in 1826 and 1862. This claim was denied by Mr. Fisher in the magazine for January, 1869, and I having, in a paper on the probable seat of volcanic action, published in the *Geological Magazine* for June last, ascribed priority in this view to Mr. Scrope, Mr. Fisher, on the occasion of the republication of my paper in your journal for October 20th, repeats his charge, and calls upon me to sustain my assertion. I might with propriety rest upon Mr. Scrope's own statement in the *Geological Magazine* above referred to, but I venture to refer your readers to the following passages in Mr. Scrope's book on Volcanos (edition of 1862), which have probably escaped the notice of Mr. Fisher. Mr. Scrope there defines volcanic eruption as "the extravasation and ebullition of subterranean mineral matters (known, so far as we are acquainted with them, to contain water), which *increased temperature* or *diminished pressure* has liquefied and caused to effervesce" (p. 309). He elsewhere speaks of the partially liquid matter beneath a volcanic vent as varying in its condition according to circumstances of temperature and pressure, which are due to changes in position, bulk, weight, cohesion, and consequent resistance of the rocks, as well as to variation in the rate of heat from below (p. 266). Those who care to follow the question of pressure in its bearings on volcanic phenomena, are referred to a little note on this subject which I have sent to the *Geological Magazine*.

Montreal, Dec. 13, 1869. T. STERRY HUNT.

MR. SCROPE, MR. FISHER, AND PROF. STERRY HUNT.—*From* MR. FISHER.

SIR,—I have, within the last week, received a letter from Dr. Sterry Hunt, in which he has kindly referred me to a passage in Mr. Scrope's Volcanos, wherein the extravasation of mineral matter is attributed to liquefaction by increased temperature *or diminished pressure*. It occurs at page 309 of the edition of 1862. Thus my letter in No. 52 of your paper has been answered.

I must, however, still think that there is a considerable difference between Mr. Scrope's view of the cause of volcanic outbursts and that hazarded by myself, as I pointed out in the *Geological Magazine* for January, 1869. I remain, &c.,

O. FISHER.

THE NOVEMBER METEOR SHOWER IN CARACAS.—*From* M. A. ERNST.

SIR,—I hope you will allow one of your earliest subscribers to trespass on your valuable space by remitting you for publication the results of the observation of the November meteors, as seen here in Caracas.

The *Sociedad de Ciencias Fisicas y Naturales de Caracas* desiring to collect facts for the study of the meteors in this year, named a committee of two members (Dr. Diaz and Sig. A. Aveledo), who, accompanied by several other gentlemen, observed the heavens in the night from the 13th to the 14th November, posted in a convenient position on the flat roof of the Colegio de Santa Maria (10° 30′ 50″ N., 69° 15′ W. Paris), 5·83 m over the street, which is 890 m over the level of the Caribbean Sea. Every observer directed his attention to a certain part of the firmament, and counted loud the meteors he saw, telling at the same time the spot where they became visible, and the direction they followed. The sky was very clouded during the greatest part of the night, so that in all no more than 405 meteors could be booked, from one o'clock, when the first was visible to 5h. 34′, when the last was seen in the dim light of the dawning day. Most of the meteors were only visible in a part of its way, the firmament being continually covered here and there by clouds; but, by tracing on a map the directions noted in the list, the lower were found to converge partly in Leo, partly in Perseus; 28 meteors were noticed from Ursus major.

The maximum observed in five minutes was 58, at 4h. 5′; and in the last minute of these five 29 were noted.

We saw from				We saw from			
1h. 0′ to 1h. 5′	...	2	meteors.	3h. 30′ ,, 3h. 35′	...	5	meteors.
1h. 5′ ,, 1h. 10′	...	1	,,	3h. 35′ ,, 3h. 40′	...	1	,,
1h. 10′ ,, 1h. 15′	...	0	,,	3h. 40′ ,, 3h. 45′	...	4	,,
1h. 15′ ,, 1h. 20′	...	2	,,	3h. 45′ ,, 3h. 50′	...	2	,,
1h. 20′ ,, 1h. 40′	...	0	,,	3h. 50′ ,, 3h. 55′	...	5	,,
1h. 40′ ,, 1h. 45′	...	7	,,	3h. 55′ ,, 4h. 0′	...	24	,,
1h. 45′ ,, 1h. 50′	...	8	,,	4h. 0′ ,, 4h. 5′	...	50	,,
1h. 50′ ,, 1h. 55′	...	6	,,	4h. 5′ ,, 4h. 10′	...	58	,,
1h. 55′ ,, 2h. 0′	...	10	,,	4h. 10′ ,, 4h. 15′	...	13	,,
2h. 0′ ,, 2h. 5′	...	15	,,	4h. 15′ ,, 4h. 20′	...	31	,,
2h. 5′ ,, 2h. 10′	...	8	,,	4h. 20′ ,, 4h. 25′	...	12	,,
2h. 10′ ,, 2h. 15′	...	8	,,	4h. 25′ ,, 4h. 30′	...	14	,,
2h. 15′ ,, 2h. 20′	...	2	,,	4h. 30′ ,, 4h. 35′	...	14	,,
2h. 20′ ,, 2h. 35′	...	0	,,	4h. 35′ ,, 4h. 40′	...	15	,,
2h. 35′ ,, 2h. 40′	...	3	,,	4h. 40′ ,, 4h. 45′	...	13	,,
2h. 40′ ,, 2h. 45′	...	3	,,	4h. 45′ ,, 4h. 50′	...	3	,,
2h. 45′ ,, 2h. 50′	...	9	,,	4h. 50′ ,, 4h. 55′	...	1	,,
2h. 50′ ,, 2h. 55′	...	6	,,	4h. 55′ ,, 5h. 0′	...	1	,,
2h. 55′ ,, 3h. 0′	...	5	,,	5h. 0′ ,, 5h. 10′	...	1	,,
3h. 0′ ,, 3h. 5′	...	8	,,	5h. 10′ ,, 5h. 20′	...	0	,,
3h. 5′ ,, 3h. 10′	...	9	,,	5h. 20′ ,, 5h. 25′	...	2	,,
3h. 10′ ,, 3h. 15′	...	15	,,	5h. 25′ ,, 5h. 30′	...	0	,,
3h. 15′ ,, 3h. 20′	...	24	,,	5h. 30′ ,, 5h. 34′	...	4	,,
3h. 20′ ,, 3h. 25′	...	6	,,				
3h. 25′ ,, 3h. 30′	...	8	,,	Total		405	

The colour was generally whitish, like the light of most planets; but there were seen two red ones, four green ones, and one blue one. A great many left phosphorescent traces; that of the red one, from Perseus at 3h. 23′, was visible for several seconds. Three reached the apparent diameter of Venus, and one surpassed it, the latter being visible through the clouds, although not even Jupiter and Sirius could be distinguished.

There was no alteration noted in the barometer, at 10h. p.m. The maximum was found with 684·11mm; the minimum at 4h. a.m., with 683·81mm (reduced to 0° C.).[1]

I am most truly yours, A. ERNST.

THE PHYSIOLOGY OF BALLOON ASCENTS.—*From* M. W. DE FONVIELLE.

MON CHER MONSIEUR,—I am very much gratified with the article you have written very ably on our work, *Aërial Travels*, and for the publishing of the last plate relating to Mr. Glashier's ascents. I think you have given some of my colleagues more than their meed of praise. And in reference to my own labours, I beg to direct your attention to the supplement I have given (see notes) on the results of Captive balloon ascents at Ashburnham Park. In perusing with some care that *résumé* you can ascertain the real state of affairs in aërial investigations. The era of real scientific aëronautics is not open yet, as real aërial observations suppose balloons worked essentially according to scientific principles by aëronauts, being strictly under the guidance of the scientific observers, and who themselves are really educated for the purpose. Every part of the balloon wants a scientific study and disquisition; viz., the invention of a good varnishing stuff better than linseed-oil, which is the only one used up to the present moment. Could you take the trouble to ascertain if *caoutchouc dissolved by sulphide of carbon* would be serviceable, if different layers, for instance, were applied severally in order to reach to a thickness of some ½ mm. together? The inconvenience of linseed-oil is attacking the envelope, which very quickly loses every resistance by the working of air oxygen, is well known. I am aware that in some respects gas derived from coal attacks india-rubber, but the contact with coal gas being only during a few hours before the ascent, and no ascent being to be fixed for more than twelve hours, the inconvenience from

[1] Our correspondent has sent us a wave diagram of the meteors, which, however, it is needless to reproduce, as his lucid account supplies all the information required.—ED. *S. O.*

the gas must be nothing to the objection arising from the contact with the air. If you can find some suggestion for meeting that difficulty you will render a real service to science in publishing it, and I will be most happy in trying it if it comes within the sphere of my opportunities. Mr. Giffard has met the difficulty most cleverly in his admirable Ashburnham Park balloon, by constructing it with several envelopes, which it is impossible to use for small balloons like the one constructing now for my private use, and which will be only able to carry two persons, me and my pupil in aëronautry, at a level of 3,000 mètres, which is sufficient for my purpose. On the 13th of December a meeting was held at the observatory under the presidence of M. Leverrier. A very able speech was delivered by M. Bert, the new Professor of Physiology to the Sorbonne, on the effects of rarefaction and condensation of the air. M. Bert quoted several *Aërial Voyages*, and the example shown by him was the fainting of Mr. Glaisher, which you have so ably translated from the vivid description drawn by your illustrious countryman. Mr. Bert has given a very clever suggestion for explaining *why people feel so well in a balloon when at a moderate level.* The diminution of pressure gives rise to an active perspiration by the innumerable pores of the skin; gases escape out of the blood, and, if the diminution of pressure is not too large, *carbonic acid*, which is obnoxious, will escape alone, while oxygen will remain. So in some respects moderate aëronauts will have their blood revivified not only through the lungs, but also *through their skin.* It shows that everything tending to promote perspiration through the skin, as the taking of a warm bath with rubbing before the ascent will be an excellent precaution. Next time that I go up into the air I will try the *trick.* I will take fresh linen too, and have my hair cleaned at the same time. But M. Bert was unquestionably wrong in explaining the fainting of Mr. Glaisher only by the diminution of pressure. One of the causes affecting your illustrious countryman was unquestionably the great cold, against which he was not protected. It is easy to procure warmth by warming the *sand* taken for ballast, or putting *warm oil* in a vase *not closed*, for fear of diminution of pressure outside leading to an explosion. Besides, Mr. Glaisher was busy taking numbers, which were entered into his aërial log-book, and are very numerous indeed. The figures in the Appendix are only a small part of them. He was writing and observing as fast as he was able to do. But when a man is observing and writing he contracts his chest, and the process of respiration is always *unfree.* Sometimes, principally in the case of careful observations, it is entirely stopped!! When people are located in a rarefied air they must, on the contrary, lean on their back, for having their perspiration as free or profound as possible, so that the quantity of the air gives some compensation for the rarefaction. Mr. Glaisher was far from taking that precaution which I know, from his own teaching, is so much wanted. It is not all, the ascent was so quick that mercury was falling perhaps a ½ in. *per minute.* Then, persons in the car were almost in the position of living beings under the *pneumatic bell*, where water can be congealed in summer by the evaporating process, *and no other cause!* If this letter was not too long, I should insist upon other theoretical considerations, showing that your illustrious countryman is far from having founded the *Colonne d'Hercules* in the air, which he is the first to acknowledge; I will explain all that at the next meeting, 13th of January, at the Royal Observatory, as well as many other considerations leading to the same end, and I expect I shall be able to show that *man is far from having penetrated into the air to the utmost heights.*

Your most faithful fellow aërial traveller,

30, *Rue des Abbesses, Paris.* W. DE FONVIELLE.[1]

ROCK MATERIAL: FROM WHENCE DERIVED.—*From* MR. G. RACE.

SIR,—In explanation of the position I take in query second in my letter in a recent issue of SCIENTIFIC OPINION, and in answer to your inquiry, "How does Mr. Race obtain littoral action without a shore, and if a shore, why not dry land?" I beg to say that in the illustration used in the above query both littoral action and dry land are implied as well as stated, and are used, not to prove that a shore can exist without dry land or *vice versâ*, but that the removal of a block of rock from a *distant* to a *near* point in space by denudic action is not essential to its attaining the pebble form.

But in my first query neither littoral action nor dry land are implied, and it is intended to elicit information as to whether water can in any other form than the littoral give to a crystal or piece of quartz the pebble form, or if it is only on a shore that water has motion so that it can subject a piece of rock to its influence, or to find out if there may have been shallows without a shore, or deeps where water action did not cease. Information on these points will oblige,

Yours respectfully,

Weardale, Dec. 24, 1869. GEORGE RACE.

[1] Our correspondent has written in English, and though his style is a little vigorous here and there, we prefer to leave his letter as written, as it expresses very forcibly the writer's views.—ED. *S. O.*

AMŒBÆ FROM ATLANTIC SEA-BED.—*From* MR. C. S. WAKE.

SIR,—I am hardly surprised at your expressing wonder at my assertion as to the presence of *Amœbœ* in an infusion of Atlantic "chalk mud." As to the truth of the assertion, however, there can be no doubt, and fortunately I am able to produce the corroborative evidence of my friend Dr. C. Carter Blake, whose letter to me on the subject you will see below. That the *Amœbœ* were not introduced from any other source I am convinced, as I have taken great care to prevent the introduction of foreign organisms into the infusions. I cannot say that, judging from the presence of other free moving organisms, I am surprised at finding *Amœbœ* under the circumstances named—the less so as I have met with them in an infusion made from the hardened sedimentary deposit attached to sea-weed taken out of the Gulf Stream, of which I send you a specimen. I may mention that about a fortnight ago I wrote to Dr. Carpenter telling him of the above facts.

While on this subject I may state that a few days ago I observed, at the bottom of a bottle containing an infusion of the "chalk-mud," a round, fluffy-looking mass, totally unlike anything I had before met with. On examining a portion of it under the microscope, I found that it consisted of a dense aggregation of fibres. It appears, in fact, to be a regular fungoid growth, presenting many of the phenomena I have elsewhere described in connection with microscopic vegetation. The most curious phenomena, although not limited to this particular case, is the association of *coccoliths* with the fibres, not a mere adhesion, but, so far as I can judge, an actual vital connection. To enable you to judge of this, I send you a slip containing a portion of the fungoid substance, and which shows other curious phenomena—notably numerous *spicules.* I am yours obediently,

Gray's-inn, Dec. 27, 1869. C. STANILAND WAKE.

Anthropological Society of London, 4, St. Martin's-place, W.C.
December 23, 1869.

MY DEAR MR. WAKE,—Without entering into the controversy respecting the microscopical discoveries you have made, I have great pleasure in expressing my entire assent to the proposition that I saw specimens, undoubtedly referrible to *Amœba*, in your slides from the Atlantic seabed. There can be no doubt that they were true *Amœbœ.* Yours very truly,

C. CARTER BLAKE, F.G.S.
Lecturer on Comparative Anatomy,
C. S. Wake, Esq., F.A.S.L. Westminster Hospital.

WHO FIRST CAPTURED PLUSIA NI?—*From* MR. DORVILLE.

SIR,—Having observed in SCIENTIFIC OPINION some interesting correspondence relating to Mr. Newman's *British Moths*, I venture to trouble you with this communication, for the purpose of drawing attention to an expression in that work calculated to mislead its readers concerning *Plusia Ni*, which I was the first to capture in this country, and which was introduced by Dr. Knaggs into our lists on the authority of my specimen.

Mr. Newman's reputation as a naturalist makes the expression to which I allude, viz., "Is said to have been taken," carry with it a doubt as to the accuracy of Dr. Knaggs's judgment; and may lead many to infer that he was in error, and that no such insect had been captured.

Surely Mr. Newman's long experience must have shown him that individual insects frequently vary, more or less, from the type-form of their species; and he should not claim for himself the sole power of furnishing an accurate description; nor should he indirectly throw doubt on the opinions of his fellow-labourers by such an expression as "*is said.*"

In order that the fact should not be subjected to a doubt, even in Mr. Newman's mind, I have submitted my insect to the inspection of Mr. Doubleday, who pronounces it to be "a very fine specimen of *Plusia Ni.*" I am, Sir, yours faithfully,

Alphington, Exeter, Dec. 24, 1869. H. DORVILLE.

DIPLODUS GIBBOSUS.—*From* MR. BARKAS, F.G.S.

SIR,—The Christmas holidays have afforded me a few hours leisure in which to clear off the shale from a mass of remains of Diplodus, which has been in my possession for a considerable period, and I desire to report to your readers the result of the examination. The slab in which the fossil remains are imbedded consists of a compact, evenly laminated, and homogeneous mass of shale, which was obtained from the Northumberland Low Main seam. The length of the piece of shale is 20 in., and the width is 12 in. Lying parallel to each other, and angularly across the shale are two masses of partially ossified cartilaginous matter; the length of one of the masses is 13 in. and the breadth is 4½ in., the length of the second mass is 9 in. and the width

4 in.; the average thickness of these semi-cartilaginous masses is about ½ in., but in some parts they are upwards of ⅝ in. in thickness. The surfaces of the cartilage are uneven, and present in various places well elevated ridges, which appear to exhibit the natural form of the cartilage rather than the results of uneven pressure after deposition. The cartilage consists of small, flat, granular fragments, which present the appearance of coarse sandstone, when examined *en masse* in a fractured part of the specimen, but on the unbroken surfaces of the remains they are small, bright, and glistening, and somewhat resemble in form and size the shagreen-like dermal covering of cartilaginous fishes, or the scales of Acanthodes. Notwithstanding the roughness of the surface of the partially ossified cartilage, the shale can be lifted from it with comparative ease, and the surface of the mass remains well exposed. Upon the shale containing the masses of cartilage, and scattered unevenly over its entire surface, there are 67 well-exposed teeth of *Diplodus gibbosus*, they are lying in every conceivable position, and present at one glance every possible aspect of the external appearance of the teeth—fronts, backs, sides, roots, apices, &c.

The average length of each tooth is ⅝ in., the largest are ½ in. long, and the smallest about $\frac{5}{16}$ in.; they are placed for the most part very nearly upon one uniform level, which corresponds with the positions of the cartilage, but at intervals where the shale has been cleared off to more than an average depth, there are distinct indications of other teeth, rendering it probable that upon and in this slab alone there are about 100 specimens of Diplodi, and these being aggregated into a comparatively small area, and deposited near masses of cartilaginous matter, make it almost certain that the whole of them belonged to one fish; and the entire absence of small teeth renders it also probable that each fish of the genus Diplodus had teeth of nearly uniform size. It may fairly be inferred that the masses of cartilage now before me belonged to the head of this coal-measure Placoid, but the order of the arrangement of the teeth is not at all indicated by the specimen in my possession, and none of the specimens in my cabinet give the least indication of the order of arrangement of the teeth. The spines of Pleuracanthus, which are supposed to belong to Diplodus, are not present on my large slab. I am yours obediently,

Newcastle-on-Tyne, Dec. 25, 1869. T. P. BARKAS, F.G.S.

SIR WILLIAM THOMSON *versus* GEOLOGY.—*From* Mr. MENTEATH.

SIR,—To answer your correspondent "R. A." I should have to discuss matters of chemico-geologic and other detail. I must hope that he will excuse my deferring my answer. I see that I cannot leave the subject of my last letter in the state I left it there, but must continue at greater length. I think that a general treatment of the matter may be useful; and if it be said that in this manner I am taking any undue advantage, I would reply that I thus expose a larger front to attack. In what follows below, and in one succeeding communication, I shall present such a general treatment; and immediately after, I shall endeavour to answer "R. A.'s" remarks—and any other objections that may appear—as fully as your space, the patience of your readers, and my own time may permit.

In the mean time, however, I would remark that I do not think I am bound to produce a clear and complete explanation of the obscure facts treated by Sir W. Thomson to justify myself in considering his opinions about those facts as vague assumptions. And, further, I would add, that I do not hold the same opinion as to the importance of the subject, in itself, that appears to be entertained by "R. A." I do not admit that, as the *North British Reviewer* has said, "By far the grandest question in geology proper is that of the original formation and early history of the earth." But I hold that the grandeur of a question of science is chiefly commensurate with its relations to truth. And, after the example of Hutton and the other geologists to whose influence we owe the superiority of British geology, I hold that questions of cosmogony have nothing to do with the *science* of geology. With the materials hitherto at our disposal, such questions cannot be seriously treated by geology or by any other science, without ignoring the principles of positive philosophy—the philosophy of neither Kant nor Comte, any more than the modern atomic theory is of Democritus, but that fashion of thought to which the results of investigation have forced scientific men. . . . .

If by "*power of reasoning*" be understood mental *force*, that is less exerted in mathematics than in any other intellectual pursuit. As Warburton truly says, "*Mathematical demonstration is the easiest exercise of reason.*" . . . . Mathematical study is the very worst gymnastic of the intellect—the very worst preparative for reasoning correctly on matters (and these are only not all the objects of human concernment) in which the mind must actively precede and not passively follow the evolution of its objects. . . . . Now mathematics are, as is universally confessed, *the easiest of all sciences*. Their perspicuity is excessive, and thus they only conduce to exercise the patience and attention. . . . . A man is made to "reason justly in mathematics" in the same manner in which a man is made to walk straight in a ditch.—HAMILTON, *Notes to Reid*.

In pure mathematics, for instance, &c. In geology (to take an instance of an opposite kind) the most extensive information is requisite; and though sound reasoning is called for in making use of the knowledge acquired, it is well known what erroneous systems have been devised by powerful reasoners who have satisfied themselves too soon with observations not sufficiently accurate and extensive. . . . . No *matter of fact* can be mathematically demonstrated, though it may be proved in such a manner as to leave no doubt on the mind. . . . . It has been rightly remarked (by Dugald Stewart) that mathematical propositions are not properly true or false in the same sense as any proposition respecting real fact is so called. —WHATELY, *Logic*.

The sciences which deal exclusively with space and time are separated by the profoundest of all distinctions from the sciences which deal with the existences that space and time contain.—SPENCER, *Class. of Sc.*

Manipulation is to chemistry what Bacon conceived mathematics to be to science, and as such "should know her place."[1]—GREVILLE WILLIAMS, *Handbook of Chem. Manip.*

I[2] quote the above, especially *à l'addresse* of Sir W. Thomson's backer in the *North British Review*. And I would, further, congratulate the latter gentleman on his admirable manner of employing two of the most ambiguous terms in the English language. "Mathematics," he says, "has the special advantage (possessed by no other method) of being able to estimate numerically the *weight* or *value* of every conclusion he furnishes." Now of three things one. Either this means that only that which is expressed in numbers is numerically expressed; a senseless truism. Or it means that numerical expression is equal to intellectual value; whence, a thousand absurdities equals a thousand truths. Or it means that only what is expressed in numbers has any important weight or value: then the following must be admitted, which, to prevent cavilling, I write in strict logical form:—

Whatever cannot be expressed in numbers has no important weight or value;

The Reviewer cannot be expressed in numbers;

∴ The Reviewer has no important weight or value.

The Reviewer himself countenances nicknaming in the present matter; I bow to his taste, and suggest that we call him Dogberry.—But I return to Sir W. Thomson.

If we found a million tombstones, inscribed with characters that could be read into intelligible and simple Latin sentences, we should conclude that the people represented by them were acquainted with the Latin language. If the letters were scattered in their arrangement, we should object to their being united so as to form an unintelligible abracadabra, however imposing to the imagination. And should a philologist inform us, that according to the principles of philology the Latin language could not have existed at the time those tombstones represented, we should reply that those principles must be drawn from all the facts concerned, and that the sooner he set to work to adapt them to the facts the better. Principles of science are simply the summed up, short-hand, results of many observations; when we reason down from principles to facts we test the value of the principles themselves: if we find them coincide with other evidence besides that which has been considered in their adoption, they are confirmed; if not, they are weakened, for the mistake may as well be on one side as on the other. The notion of absolute truth by deductions is an ancient phantasm. Could Archimedes have found a fixed point, he might have moved the world; but no fixed point has ever yet been found, nor is there any ground of presumption that one ever will be found. This is the old striving of the Hermetics for the Stone, that often ended in the self-delusion that they had attained it; it reminds us of Paracelsus and the brandy-bottle, with the delusive elevation of its effects.

But what does Sir W. Thomson mean by the principles of natural-philosophy? Does the contradiction he asserts really exist between those principles and the results of geology; or are there in Sir W. Thomson's arguments certain merely conjectural assumptions slipped in among truths of physics and mathematics, and on which the geological bearing of his arguments altogether depends, thus explaining why such attacks are not made or countenanced by others equally well acquainted with the principles of natural philosophy. The latter is the case. The geological bearing of Sir W. Thomson's arguments depends on the following assumptions:—

1. *That the heat observed in mines and other excavations represents the earth's original heat.*—The question of the origin of such observed heat we know to be an extremely complex one. The science of chemical geology, raised by such observers as Bischof and Delesse, shows that many really existing causes of that heat must be at least allowed for in our estimations; and affords a strong presumption, especially considering the imperfect state of our knowledge regarding the conduction of heat in rocks, that the heat observed may be entirely due to buried organic matter, electricity, pressure, friction, and other such causes. Sir W. Thomson's choice of the view that suits his purpose can only be founded on mere conjectural assumption.

2. *That the observed retardation of the earth's rotation represents the effect of tidal retardation.*—It is admitted that this observed retardation may be due to variation in the quantity of ice at the poles, or to the fall of meteorites. Professor Huxley cannot be expected to show that a slight rise in the average level of the sea has taken place during the last twenty-five centuries, for the obvious reason that no means of making such a measurement exist. But, similarly, it may be asked can Sir W. Thomson show any probability that the

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[1] I have not a Bacon at hand.

[2] Errata in last letter: principle for *principles*; Abaderas for *Abaderas*; Ballées for *Vallées*.

natural condition of the universe is a state of chaotic porridge? We know that the ice at the poles *has* greatly varied, and that meteorites *do* fall. But the *à priori* argument for tidal retardations when opposed to the results of geology, recalls the objection of Galileo's opponents that if the earth rotated the bodies on its surface would fly off. Sir W. Thomson's choice of the view that suits his purpose can here also be only founded on mere conjecture. It may even be said that here there is a presumption against the view he chooses, and the amount of the retardation actually ascertained is very hypothetical.

3. *That the present general form of the earth was acquired by consolidation from a state of fusion, and has remained unchanged ever since.* —This form of the earth, it has been shown (see Juke's "Manual," &c.), would naturally result from the action of denudation) with winds, currents, &c.), whatever it might have been originally. There is certainly strong reason to believe it could not have remained unchanged. This also, then, is at best a mere assumption.

4. "The estimates here are necessarily very vague, but yet, vague as they are, I do not know that it is possible, upon any reasonable estimate, founded on known properties of matter, to say that we can believe the sun has really illuminated the earth for five hundred million years." These words of Sir W. Thomson's I think relieve me from the obligation to prove by argument that his reasoning from the sun's heat is grounded on mere conjecture; and surely Sir W.Thomson does not really suppose that a "submarine wire," or an "underground railway," are adequate representations of the necessary alternative. It is quite true that the human mind has "a wish to investigate and a capacity for investigating;" but I have always understood that a chief element of scientific discipline is the learning not to frame solutions till we have a pretty intimate knowledge of the facts concerning what we wish to explain. Now have we, as yet, any satisfactory knowledge of the facts concerning the origin and ultimate nature of the sun's heat? Has not Sir W. Thomson been too exclusively engaged with the phenomena of artificial machines when framing the principle of the dissipation of energy? And is he really so certain of the universality and adequacy of his knowledge that he can fairly call the phenomena of the sun's heat a miracle if they do not at once adapt themselves to the principles he admits? Whence comes the new *universal principle* of the dissipation of energy, since to it the vast field of solid facts embraced by geology is to be adapted as best it may, and the sun to be called a miracle, or else disposed of in any manner that may suit that "principle"? Such speculations may be interesting and entertaining in themselves, but when set against the serious results of science they become absurd.

Well, now, Sir W. Thomson's argument from the heat of the earth involves the admission of the grounds of his argument from the sun's heat; and his argument from the form of the earth involves the admission of the grounds of his argument from the heat of the earth; so that his reasoning is not "strictly cumulative" as the *North British Reviewer* has said. And his arguments are altogether dependent on mere conjecture. And his conclusions do not even strictly follow from these conjectures; but subordinate assumptions are introduced in the working out. So that his premises, being merely conjectural, his conclusions are less than merely conjectural. Therefore, I hold that I am justified in employing the term "vague assumptions" to characterize Sir W. Thomson's objections to geology. And if it be said that I prove too much, a similar charge may be made against the arguments of Sir W. Thomson.

According to these assumptions a certain superior limit is assigned as the *highest* allowable to geological times. Against this stands the general testimony of geologists to the necessity of admitting a much longer period, as the *lowest* that can be adapted, without the introduction of violent and unjustified hypothesis, to the explanation of the geological record; and over and above this testimony there stands, first, the strong probability that, owing to the imperfection of the geological record, a much longer time must be admitted; secondly, the clear possibility that the geological record, spared by the ever active processes of metamorphism, may represent but a trifling fragment of the history of the earth; and, thirdly, the *remarkable* absence throughout so rich a field as that of geology of any traces of a beginning, or anything affording clear presumption of an end.

The principle of the degradation of energy has only very recently been introduced into physics. The principles of Hutton have been growing in strength ever since the end of the last century. That geology on these principles is geology proper, and that catastrophism is merely a temporary aberration; that the one is consistent with reason and the results of philosophy, and the other consistent with contradiction and the results of sophistry, I propose to indicate in a succeeding communication. At the same time, I shall endeavour to show that evolutionism—seemingly here a product of the peculiarly British philosophy of universal compromise—is also unjustified, and to indicate briefly the true genesis and practical bearings of the contradiction between geology and the opinions of Sir W. Thomson.

For the present I find the arguments of Sir W. Thomson depend essentially on mere conjecture. As such they have no claim to modify or in any sense disturb the generalizations from facts that resume the vast and serious science of geology. Conjectures drawn from scarce trodden fields of research cannot, although dressed up in all the panoply of mathematics, interfere with the results of largely grounded and infinitely confirmed investigation; although speculation, *not inconsistent with such results*, may be admissible, even when, from the obscurity of its field, it may be necessarily vague. And hence, even should those views of the obscure questions concerned in Sir W. Thomson's arguments, which we may accept as an alternative to his views, prove vague, and more or less unsatisfactory, yet they possess the inestimable advantage of not contradicting the results of serious investigation—an advantage that, in matters of ultra-scientific speculation, I cannot but regard as supreme.

If I am mistaken in my estimation of the worth of Sir W. Thomson's arguments, and it should appear that they are good ones, the question will then be as to their relative worth, compared to the evidence of geology. To strike a balance of that sort would, I submit, be rather difficult: I should be sorry to attempt it. But supposing that accomplished, it would then be time to consider the manner and the scope of the reform so positively demanded by Sir W. Thomson. For surely that reform would require discussion. As I can at present make any sense of it, it seems to mean that geologists are to throw away the traditions of their science and the long result of all admittedly correct reasoning and responsible accurate survey, and to accept in place of these any loose notions and *à priori* theories that happen to suit, at any given date, the latest pursuits of Sir W. Thomson in his particular field. The reform he proposes seems a reform of the human intellect, to make us all Sir W. Thomsons, or rather to establish a scientific ultramontanism, Sir W. Thomson as pope. If geology is a branch of physics, physics is a branch of geology. But geologists will not trouble themselves with reforming so hopeless a case as Sir W. Thomson's. Happily, the physics taught at Glasgow is not necessarily the standard of British physics any more than the geology taught thirty years ago at Glasgow (whatever that may have been) was the standard of British geology.

I have indicated, I think, some of the difficulties and relations of the question; I can pretend to little more, but believe I can support what I have said.

Lastly, as I may fairly be accused of undue presumption in venturing on the criticism of so difficult a matter as the discussion in hand, I would reply, that I think the subject cannot fitly be dropped after the extraordinary statement of it that has appeared in so influential a journal as the *North British Review*. I have waited in hope that it would be continued by some worthier hand; but, so far as I am aware, it has been dropped. Therefore I have ventured to reopen it, and am ready to defend my words. I speak as a private in the ranks of science, but the principles I am defending I believe to be truth; and I remember the ancient adage, "Quid times, Cæsarem vehis."

I remain, &c.,

St. Jean de Luz, Dec. 18, 1869. P. W. STUART MENTEATH.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

GEOLOGICAL SOCIETY.

DECEMBER 22ND.—Professor Huxley, LL.D., F.R.S., in the chair. John Hopkinson, Esq., of 8, Lawn-road, Haverstock-hill, N.; Samuel John Sanders, Esq., M.A., vice-master of the Beds Middle-class Public School; and Jabez Church, Esq., C.E., of 17B, Great George-street, Westminster, S.W., and Chelmsford, Essex, were elected fellows of the society. The following communications were read:—

"On the Iron-ores Associated with the Basalts of the North-east of Ireland," by Ralph Tate, Esq., Assoc. Linn. Soc., F.G.S.; and John S. Holden, M.D., F.G.S.—The authors introduced their account of the iron-ores of the Antrim basalts, by stating that since 1790 an iron band had been known in the midst of the basalt of the Giant's Causeway, but that only within the last few years have further discoveries been made, which have developed a new branch of industry in the north-east of Ireland. The iron-ore of the numerous exposures was considered to represent portions of one sheet extending uniformly throughout the basalt and over a very large area. Indeed, everywhere the iron band and its associated rock-masses present identical features, from which the authors deduced the following generalized section:—

The underlying basalt gradually passes upwards into a variegated lithomarge of about 30 ft. thick, graduating insensibly into a red or

yellow ochre or bole of about ½ ft. in thickness, which passes into a dense red ochreous mass of about 2 ft., charged with ferruginous spheroids consisting chiefly of a protoxide and peroxide. The spheroids are of the average size of peas; they increase in number and size towards the upper part of the band, and not unfrequently constitute that portion of it. The line of junction between the iron band and the overlying, and usually more or less columnar basalt, is in all cases well defined, and in a few instances exhibits decided unconformability.

The authors discussed the several theories that may be suggested to account for the origin of the present condition of the pisolitic ore, and proceeded to point out what appear to have been the several stages of metamorphic action by which the pisolitic ore had been elaborated out of basalt. From field observations and chemical analyses, they have been led to consider the bole and lithomarge as the resultants of aqueous action in combination with acidulated gases, which, dissolving out certain mineral substances, has effected the decomposition of the basalts; and to assume that the bole underlying the iron band was a wet terrestrial surface, and that the subsequent outflow of basalt effected, by its heat, pressure, and evolved gases, a reduction of the contained oxides of iron into the more concentrated form in which they occur in the pisolite, the aggregation of the ferruginous particles being a result of the same actions.

The ferruginous series, which interstratified plant-beds at Ballypalidy, was next described, and demonstrated to be of sedimentary origin; the ferruginous conglomerate resulting from the degradation of the pisolitic ore, of which it is chiefly reconstructed, and of the underlying ochres.

Many additions were made to the list of plant-remains from these beds; and priority of discovery of plants in the Antrim basalts was accorded to Dr. Bryce, F.G.S.

Discussion.—Mr. D. Forbes was not prepared to admit some of the theoretical conclusions of the authors, and objected to calling in metamorphism to account for all that was hard to be understood. He could not recognize the division of beds so similar in character into two classes. He wished to know, assuming that the iron-ore merely resulted from the decomposition of the basalt, what became of all the silica and alumina which constituted three-fourths of the mass. The origin of the pisolitic ores was, in fact, organic. In Sweden certain lakes were regularly dredged each year for the pisolitic ore still in course of formation by means of confervoid algæ. He, therefore, regarded the whole of these beds as in a certain sense sedimentary, and though due to organic agency, yet still deriving their original mineral matter indirectly from the basalt. The basalt contained a considerable amount both of phosphorus and sulphur: and if the ores had been derived directly from the basalt, both these substances would have been present in them. This was an argument against any direct metamorphism. The presence of vanadium afforded additional reason for regarding these ores as formed in the same manner as bog iron and similar ores.

Sir Charles Lyell had observed in the basalts of Madeira red ochreous bands, which represented old land surfaces, in one of which Mr. Hartog and he had discovered a leaf-bed containing vegetation of much the same character as that of the island at the present day. Near Catania, in a recent lava-stream, he had seen the junction of the lava with the soil of the ancient gardens; and in character the soil now under the lava resembled the red beds in Madeira.

Mr. W. W. Smith was, on the whole, inclined to admit the power of metamorphism to produce such changes as had been here effected. He commented on the advantages of employing this Irish ore for admixture with hæmatitic ore, on account of the abundance of alumina present. Possibly there had been some difference in the chemical character of the different flows of basalt.

Mr. Evans suggested that the Ballypalidy beds might be the littoral deposits of a lake in which the pisolitic ores of the other parts of Antrim were deposited further from the shore, and subsequently buried under a basaltic flow.

Mr. Etheridge inquired whether the pisolitic ore had been subjected to microscopic examination, with a view of finding traces of organic forms, such as Gallionella.

Mr. Tate, in reply, defended his views as to metamorphic action. He thought the uniformity in thickness and character of the pisolitic ore band over so large an area showed that it could not be a lacustrine deposit. He had not as yet examined the spheroids under the microscope.

"Notes on the Structure of *Sigillaria*," by Principal Dawson, F.R.S., F.G.S., Montreal."—In this paper the author criticised the statements of Mr. Carruthers on the structure of Sigillaria (see *Q. J. G. S.* xxv. p. 248). He remarked that Sigillaria, as evidenced by his specimens, is not coniferous; that the coniferous trunks found in the coal-formation of Nova Scotia do not present discigerous tissue of the same type as that of Sigillaria; that no Conifer has a slender woody axis surrounded by an enormously thick bark; that Calamodendron was probably a Gymnosperm, and allied to Sigillari; that although Stigmaria may not always show medullary rays, the distinct separation of the wood into wedges is an evidence of their having existed; that the difference in minute structure between Sigillaria and Stigmaria involves no serious difficulty if the former be regarded as allied to Cycadaceæ; and further, that we do not know how many of the Stigmariæ belong to Sigillaria proper, or Favularia, or to such forms as Clathraria and Leioderma, which may have been more nearly allied to Lepidophloios; that the fruit figured by Goldenberg as that of Sigillaria is more probably that of Lepidophloios, or may be a male katkin with pollen; and that he has found Trigonocarpa scattered around the trunks of Sigillariæ, and on the surface of the soil on which they grew. He agreed with Mr. Carruthers in regarding Mr. Binney's *Sigillaria vascularis* as allied to Lepidodendron.

Discussion.—Professor Morris thought that Clathraria and Lepidophloios ought to be discriminated from the Sigillariæ, as being rather more nearly allied with cycadaceous plants, especially the former. He pointed out the manner in which certain vascular bundles communicating between the centre of the stem of Sigillaria and allied genera and their bark might be mistaken for medullary rays.

"Note on some new Animal Remains from the Carboniferous and Devonian of Canada," by Principal Dawson, F.R.S., F.G.S., Montreal.—The author described the characters presented by the lower jaw of an Amphibian, of which a cast had occurred in the coarse sandstone of the coal-formation between Ragged Reef and the Joggins Coal-mine. It measured 6 in. in length; its surface was marked on the lower and posterior part with a network of ridges inclosing rounded depressions. The anterior part of the jaw had contained about 16 teeth, some of which remained in the matrix. These were stout, conical, and blunt, with large pulp-cavities, and about 32 longitudinal striæ, corresponding to the same number of folds of dentine. The author stated that this jaw resembled most closely those of Baphetes and Dendrerpeton, but more especially the former. He regarded it as distinct from *Baphetes planiceps*, and proposed for it the name of *B. minor*. If distinct, this raises the number of species of Amphibia from the Coal-measures of Nova Scotia to nine. The author also noticed some insect remains found by him in slabs containing Sphenophyllum. They were referred by Mr. Scudder to the Blattariæ. From the Devonian beds of Gaspé the author stated that he had obtained a small species of Cephalaspis, the first yet detected in America. With it were spines of Machairacanthus and remains of some other fishes. At Gaspé he had also obtained a new species of Psilophyton, several trunks of Prototaxites, and a species of Cyclostigma.

Discussion.—The president objected to the term Reptiles being applied to Amphibia, from which they were totally distinct. He questioned the safety of attributing the jaw to Baphetes, of which no lower jaw had been previously found. Mr. Etheridge remarked that the Cephalaspis differed materially in its proportions from any in either the Russian or British rocks.

"Note on a Crocodilian Skull from Kimmeridge Bay, Dorset," by J. W. Hulke, F.R.S., F.G.S.—The author described a large Steneosaurian skull in the British Museum, from Kimmeridge Bay, which had been previously regarded as Pliosaurian, and was recently identified with Dakosaurus by Mr. Davies, sen. From the agreement of their dimensions, and their occurrence near together, the author thought it probable that this skull and the lower jaw described by him last session belonged to the same individual. It differs from the *Steneosaurus rostro-minor* in the greater stoutness of its snout, in the presence of an anterior pair of nasal bones prolonged into the nostril, and in the number of its teeth. The author proposed to name it *Stenosaurus Manseli*, after its discoverer.

"Note on some Teeth associated with two Fragments of a Jaw, from Kimmeridge Bay," by J. W. Hulke, F.R.S., F.G.S.—The author described some small teeth associated with fragments of a long slender snout not unlike that of an Ichthyosaur, but too incomplete to be certainly identified. The teeth are peculiar in the great development of the cementum, which gives the base of the tooth the form of a small bulb. The exserted crowns are slightly curved, smooth, cylindrical, and pointed. The attachment to the dentary bone was probably by means of the soft tissues, and the teeth seem to have been seated in an open groove in the surface of the jawbone. Until additional material reveals the true nature of the fossil, the author proposes to place it alone, and to call it provisionally, *Euthekiodon*.

The following specimens were exhibited:—Fossils and Rock-specimens from Antrim, exhibited by Ralph Tate, Esq., F.G.S.; Fossils from Kimmeridge Bay, exhibited by J. W. Hulke, Esq., F.R.S.

STATISTICAL SOCIETY.

On Tuesday evening, December 21, William Newmarch, Esq., F.R.S., president, in the chair, a report on the seventh international Statistical Congress at the Hague, was read by Mr. Samuel Brown, after which Mr. R. H. Inglis Palgrave read a paper on the house accommodation of England and Wales. Mr. Palgrave commenced by stating that the population of England is now, probably, better housed than at the commencement of the century. The average number of inhabitants to

a house has slightly diminished since 1801. Mr. Palgrave continued to point out that, covered by a general average, which appeared to show ample accommodation, were great inequalities. The information obtained in the English census inquiries scarcely gives the means of tracing the subject further; but the last census in Scotland showed that one-third of the population lived, each family in dwellings of two rooms; only the remaining third being lodged with comfort and decency. Mr. Palgrave showed, by an analysis of Mr. Dudley Baxter's calculations, that the lowest section of the population in England was nearly twice as closely packed as the general average, in dwellings more than proportionally inferior, and by a reference to the report on the employment of children and women in agriculture, that the condition of some rural districts, apparently well provided for, was scarcely superior to that of Scotland. Mr. Palgrave concluded by proposing that the census inquiry for 1871 should include more details on the house accommodation of England, Wales, and Scotland,—thus to ascertain present deficiencies, and assist those who desire to remedy the evils arising thence.

The following gentlemen were elected Fellows—viz., Sir Massey Lopes, Bart., M.P., Hon. H. N. D. Beyts, Dr. Macauley, Messrs. J. O. Chadwick, A. H. Smee, C. Inglis, M.D., Hammond Chubb, J. Ingall, and James M. Davies.

INSTITUTE OF ACTUARIES.

THE second ordinary meeting of the present session was held on Monday, the 21st December, Samuel Brown, Esq., president, in the chair. The following gentlemen were elected members, viz:—Fellows, Messrs. Cornelius Walford and Joseph J. Dymond; and Associates, Messrs. A. C. Waters, Ainslie Talon, E. J. Sims, jun., Henry Ieula, J. D. Hobson, J. Ashton, J. H. Elder, and Joseph Burne. Mr. J. B. Sprague, M.A., read a paper "On the Rate of Mortality prevailing among Assured Lives as influenced by the length of time for which they have been assured."

SOCIETY OF ANTIQUARIES.

DECEMBER 2ND.—Earl Stanhope, president, in the chair. The Lord Bishop-elect of Winchester was declared to be duly elected a member of council, in the room of the late Mr. John Bruce.

Mr. Octavius Morgan, V.P., exhibited and presented a wax impression of the official seal of John Morgan, Esq., of Tredegar, custos rotulorum for the county of Monmouth from 1700, and Lord-Lieutenant of Monmouth and Brecon from 1715 to 1719.

Mr. E. W. Brabrook exhibited an edition of *Juvenal and Persius*, dated 1603, and bearing the autograph of Ben Jonson as follows: "Sũ Ben. Jonsonii Liber." He had bought it for sixpence among the duplicates offered for sale by the learned Society of Lincoln's Inn; an inn which Ben Jonson, trowel in hand, had helped to build, and which now denies him a resting-place for his autograph.

Mr. W. M. Wylie exhibited a drawing of a bronze car found in the South of Italy.

The Rev. J. T. Fowler exhibited two figures carved in ivory or bone. One was probably a chessman, and was in the costume of a German Emperor; the other was a figure of the Virgin and Child. Both were probably late 14th century work.

Mr. O. Morgan read a paper "On a Chalice of the 15th Century, and on Chalices generally."

LIVERPOOL GEOLOGICAL SOCIETY.

A MEETING of this society was held on Tuesday, Dec. 14th, at the Royal Institution, Colquit-street. The president, G. H. Morton, Esq., F.G.S., occupied the chair. Several new members were elected.

The vice-president (Dr. C. Ricketts, F.G.S.), Mr. Isaac Roberts, and Mr. Alfred Morgan each called the attention of the members to objects of geological interest collected by them.

A paper was then read by Mr. Norman Tate "On the Chemistry of Granites, as Illustrating the Origin of Granitic Rocks."—The author stated that he was of opinion that chemistry was too much neglected by geologists, although the subjects which geologists took cognizance of could not properly be considered without calling in the aid of chemistry. He gave a *résumé* of such chemical investigations and discoveries as relate to granite and the minerals of which it is composed, including not only analytical researches as to their composition, but also such experiments as have been made to endeavour to form these minerals artificially. He particularly called attention to the papers of Professor Haughton, "On the Granites of Ireland," and the chemical and microscopical researches of Mr. Sorby, and likewise alluded to the late discussion between Dr. Sterry Hunt and Mr. David Forbes, agreeing, however, for the most part with Mr. Forbes.

A somewhat long and interesting discussion then ensued, in which Dr. Ricketts, Messrs. T. Roberts, Morgan, Abraham, and Bostock, and the president took part.

After a vote of thanks for the paper, Mr. Alfred Morgan read a communication "On the Formation of Metalliferous Veins."—This paper was intended to be a *résumé* of the usually received theories on the formation and filling of metalliferous veins, and at the same time introductory to other communications which Mr. Morgan intends making to the society. After referring to those treatises which have been written on the subject, among which are the valuable researches of Mr. R. Were Fox, Sir H. de la Beche, MM. Daubrée, Elie de Beaumont, Bischoff, &c., Mr. Morgan made some observations on the large amount of careful investigation it has received at the hands of continental-*savants*, from the time of Werner at Freiburg to our own day. This is probably due to the fact that the majority of the mines on the continent are State property, and are worked under the control of efficient Governmental mining corps. The author then remarked that the same mechanical, chemical, and electrical forces are still in operation that acted originally in the formation of ore-veins. No geologist now doubts that metalliferous veins were primarily fissures. And, in support of this hypothesis, Mr. Morgan cited the invariable coincidence of veins with ordinary faults, and exhibited sections of a mine in Cornwall showing the lateral displacement of the veins from this cause. Among further evidences, he mentioned that the opposite walls of a vein are frequently *slickensides*; that they sometimes contain well-rounded pebbles and shells, which have evidently been derived from the surface; and, that a parallelism of direction is maintained. Mr. Morgan then referred to the filling of veins by means of sublimation, and pointed that this means must have performed an important part in the production of ores. With respect to the filling of cavities with metalliferous matter by segregation from the surrounding rocks, the author quoted instances in which the spaces originally occupied by fossil organisms had been refilled with metallic substances, such as copper-pyrites and sulphurate of lead. He observed that, though it is probable that all rock cavities have a tendency to be filled with mineral matter, by means of infiltration, it is necessary to take into account other conditions in the case of fissures of such vast extent as mineral veins. That all such fissures were at one period the channels by which hot-springs holding the various metals in solution made their way to the surface will probably not be doubted. Mr. Morgan referred to the increased solvent power of water as we may suppose it existed at great depths, and under conditions of increased temperature and pressure. He then noticed the uniform nature of the elements of volcanic emanations, thermal springs, and mineral veins. He thought some geologists spoke rather presumptively of the mid-terrestrial region. But, little as is known of the central portion of our planet, it is certain that the mean density of substances there is much greater than at the surface. According to La Place, the difference is 0·55. After pointing out that the contents of thermal springs and mineral veins might be expected to show some difference, the author proceeded to show that it is only by taking into account all these agencies, viz., the action of thermal springs, segregation, volatilization, and conditions of increased temperature and pressure, and chemical action and reaction that we can offer any adequate explanation of the origin and arrangement of metalliferous deposits. Mr. Morgan concluded his paper by referring to the action of electricity, which has, to a large extent, determined the nature of the metallic deposits. He exhibited a section of the Derbyshire limestone with interposed trap-rocks, locally termed *toadstones*. The same vein which is rich in the former may be almost unproductive in the latter. A similar phenomenon is observed in Cornwall, where the nature of veins is very greatly affected as they pass through granite or killas.

The thanks of the society were presented to Mr. Morgan for his communication.

YORKSHIRE PHILOSOPHICAL SOCIETY.

ON Tuesday, Dec. 14, the monthly meeting of this society was held at the Museum, the chair being occupied by R. Davies, Esq.

George Waugh, Esq., M.B., of the York Dispensary, was elected an associate, and T. Christie, M.D., medical superintendent of the North-Riding Asylum, a member of the society.

T. S. Noble, Esq., F.R.A.S., the secretary, read the following list of specimens:—Tooth of *Elephas primigenius* found near Holgate, presented by George Mennell, Esq.; a parrot fish from the Indian Sea, and a bone of the walrus, by W. H. R. Read, Esq., of York; and a collection of flints, by E. Allen, Esq., also of that city.

The Rev. J. Kenrick, M.A., F.S.A., called attention to the discovery of a fragment of a Roman pavement in the graveyard of St. Mary's Church, in Castlegate, now undergoing restoration by the munificence of the Dean. It is imperfect, but its discovery is important as the first Roman antiquity found in that neighbourhood. But when the alterations in the Castle Yard took place two sarcophagi were found, one of which, that of Auralius Superus, is in the lower room of the Hospitium. As the Romans usually placed their tombs beside a public

way, it is probable that a road led through Castlegate to the Fosse, then a very different stream from what it is now.

Mr. E. Allen, F.G.S., then read a paper on the flints which he had presented, and it was to the following effect:—The flint implements which I present to the society, consist of a beautiful polished axe-head, spear-heads, thumb-scrapers, and flakes or knives. They were found during the autumn of 1868, by workmen who were excavating the foundation of the gasworks of the North-Eastern Railway Company. The works are situated about two miles from York, on the north line, near to Acomb Landing. The field in which the flints were found had been pasture land. There was about one foot of surface soil, and a bed of sand below this, in which the implements were deposited about 5 or 6 ft. deep. The flints are of the Neolithic period, the axes being beautifully polished. I have very carefully examined the men respecting the circumstances under which they were found; with the following result:—Thomas Chapman, foreman of the workmen, and Martin Hughes, one of the labourers, who were present when the discovery was made, inform me that the stone implements were lying in a space of not more than 2 ft. in diameter. They state there were from 14 to 20 axe-heads, many spear-heads, and at least a bushel of flakes. Most of the axe and spear heads were sent to Mr. Cabry's office. Mr. Cabry subsequently gave them to Mr. Chas. Monkman, of Malton. The flakes were not thought to have been of any value, and were removed along with the sand, and used as ballast for the line. I obtained most of my specimens from Martin Hughes, who was working next to the man who made the discovery. No other implements were found in the neighbourhood, although the sand bed was removed for several hundred yards, and excavated for some depth. The archæologists who first saw them were of opinion that the flints had been found in an undisturbed sand bed. I think this is an error. I have made particular inquiries of the foreman of the workmen, and he distinctly states that there was a layer of gravel over the implements with which the holes where they were deposited had been filled up. This opinion is corroborated by the fact of the flints being all found in close proximity, and not any others being found in the sand bed. It is, therefore, I think, most probable that they had been buried by their owners, and from their great number, that they had been the property of a manufacturer, or, at any rate, a dealer in stone implements. This view is also strengthened by the appearance of the flints, for they have not been blunted by use, their edges being quite sharp, and their surfaces finely polished. It is difficult to assign any definite age to these relics, unconnected as they are with any other remains. The period when those who used them lived can only be conjectured. Mr. Cook, of Holgate, has in his possession two axe-heads, which were found some years ago in the same locality on the surface of the soil. They are constructed on the same type, but composed not of flint but of felstone. I do not think there is any reason for claiming a high antiquity for these implements. They are polished, and therefore of the later stone period. It is probable they may be assigned to a period little anterior to historic times, and that they were fashioned by one of the more ancient British tribes, whose rude huts occupied the site of the new gasworks, and whose hunting ground is now traversed by the North-Eastern Railway Company.

The Rev. J. Kenrick then read the following paper "On the Use of Stone Implements considered in Reference to the History of Civilization."—It was my intention to have followed the remarks which I made on Mr. Barugh's and Mr. Tindal's donations of flint implements from the Bridlington Wolds, by considering the relation in which the use of stone implements stands to the history of civilization. I now take up this subject, which want of time prevented my then entering upon. The general conception of this relation is simple enough. As man is supposed to have advanced from the state of a hunter to that of a nomadic shepherd, and from that to the higher stage of an agriculturist, so he is supposed to have begun his progress in the art of flint tool making with the rude *hache* of the valley of the Somme, and to have gradually perfected his art, till it reached the skill which is displayed in the polished celt and the barbed arrow, or the still more finished specimens of the Copenhagen museum. But neither of these opinions has been without opponents. The doctrine of man's progressive advance from the hunting to the agricultural state, which had been assumed by several Scotch writers, as Lord Kames, Professors Millar of Glasgow, and Adam Ferguson, was strongly controverted, I think by a clergyman of the Scotch Episcopal Church, in a little volume, published in the latter part of the last century. His argument was, that history contradicts the theory of man's progressive advance in civilization by an inherent power of improvement; for that we have no evidence that any savage tribe ever did so advance, except by contact with one already civilized. And the same question has naturally been revived by the supposed discovery that an age of stone implements preceded that of bronze, as bronze that of iron, making a gradual improvement in the arts of life, wrought out by man himself under the influence of his impulse to perpetual advance. Those who dissent from it take partly the same ground as the author whom I referred to before. And they consider the savage who knows only a rude flint implement, not as the germ and forefather of a highly civilized race, but as an outcast from a more advanced society, who, driven by conquest or want of sustenance into an inhospitable region, has lost the arts which his forefathers possessed. According to the one view the Esquimaux, whom flint and bone serve instead of bronze and iron, represents the condition in which the most civilized nations once existed. According to the other, he only shows how low a human being may fall in the scale of civilization under the pressure of unfavourable circumstances. Such are the two hostile sects to which the discovery of the division of the stone, bronze, and iron ages has given rise. "*Magno se judice quisque tuetur.*" On the one side we have the Archbishop of Dublin and the Duke of Argyll; on the other, Sir John Lubbock, Sir Charles Lyell, and Mr. Evans, with, I presume, all the followers of Mr. Darwin and Professor Huxley.

It is a fair question to be discussed on historical and scientific evidence; and the Duke of Argyll accepts this ground, and deprecates the introduction of theological topics into the argument. It is quite true that we have no historical evidence of the advance of a tribe from hunters to agriculturists and merchants, or from the exclusive use of flint implements to those of bronze and iron, without foreign communication. But is it reasonable in this case to expect historical evidence? Who is to furnish it? Not the savage himself, for he would cease to be a savage if he had a history. Not the civilised man, who reports his condition, for he cannot report more than the savage has to tell him. The only case from which any inference could be drawn would be, when a civilized nation has had a tribe of savages under its observation for a series of years, without communicating any of its own acts to them, and reports that they continue precisely in the same low state as that in which they were found. Even then the stationary condition of the savage would not demonstrate his incapacity of self-improvement; it might be only an instance of obstinate adherence to old customs which is not peculiar to uncivilised nations, or jealousy of the stranger whom he naturally regards as an intruder and an enemy. It is, however, the less necessary to argue against the notion that the savage is incapable of improvement, because on this point the Duke entirely disagrees with the Archbishop, and admits an inherent capacity for improvement and impulse towards it to be an essential part of human nature. He combines with this, it is true, an inherent principle of degeneracy in man, by which the tendency to improvement is constantly counteracted, and he instances cases in which a pure religion has degenerated into superstition, and pure morals into general corruption. But this is to confuse the question by the introduction of an extraneous element. By civilization we understand the arts of life. The Indian, who believes only in a Great Spirit, may be superior in his religion to the Athenians whom St. Paul rebuked for their superstition, but this affords no ground for supposing that a nation which had once known the use of bronze and iron would so far degenerate as to betake itself to stone. Analogy leads us to assume the less perfect as the parent of the more perfect. We do not suppose the crab to be a degenerated pippin, or the sloe a degenerated plum; we regard the wild bovine races as progenitors of our domestic herds, and the products of the hedgerows as the origin, under culture and improvement, of the orchard and the garden. The grasses are not cereals run wild, but the cereals are grasses brought by human art to furnish food for man. We naturally apply the same principle to man himself, and conclude the less perfect to be the germ of the most perfect.

And this analogical presumption as to prehistoric man is confirmed by what we know of him in historic times. By gradual progression (*pedetentim progrediendo*) he has made perpetual advances in civilization. They have been slow, they have been partial, they have been interrupted, but these disturbances have been temporary and local. Looking at history as a whole we may truly say the genius of the human race has ever been progressive. There can now be no question that in Europe there has been a time when its inhabitants had no other tools than those which nature furnished; stone, wood, bone, horn. Whether they taught themselves, or were taught by others, the use, first of brass and then of iron, is not so clear. But are we authorized hence to conclude that in other countries man has passed through a similar stage of civilization? No man would maintain that such an age was simultaneous over the whole area occupied by the human race. The use of stone implements in ancient religious rites and customs in countries possessing much more perfect instruments, as in Egypt and Italy, has been used as an argument that there was a time in their history when they had no others. The argument is good as far as it goes, but its extent is very partial. The same thing may be said of the evidence derived from the discovery of stone implements, unaccompanied by metal ones, and evidently fashioned without the use of them, in drift, in caves, in sepulchral mounds, on the surface, in submerged habitations, in various countries of Europe. Evidence is wanting that such a state of the arts once prevailed in other countries. But it should be considered how recently this evidence has been brought to light in Europe. Fifty years ago it would have been impossible to have maintained, with any plausibility, the hypothesis that Europe has had its stone age; but, curiosity once

stimulating research, what a multitude of curious facts and instructive specimens have been brought to light! Even from the old seats of civilization in the East a few such specimens have been produced, and as these have never been systematically explored, no argument can be derived from their rarity or their absence. It is not probable that in any case they should be numerous, as we know by every-day experience that civilization tends to eradicate the monuments and usages of antiquity. Zoology may speculate on man before he had become in form and faculties what we see him, but history knows him only as a *biped*, walking erect, possessing, whatever be the form of his skull, or its cubic contents of brain, or its facial angle, the same limbs, organs, faculties, affections as ourselves. Of these faculties that of self-improvement belongs to man alone of all animated species, separating him from the most highly organized of inferior animals. We see it at work from the very dawn of written and traditional history; is there any good reason to believe that it was inherent in prehistoric times? If not, then it seems a just conclusion that the steps of his progress, which we cannot trace, have been made, like those which we can, without extraneous aid, by the development of powers and instincts which are essential to his nature. Beyond this presumption it seems to me that, in the present state of our knowledge, we are not authorized to advance.

Mr. J. Ford moved a vote of thanks to the donors of books and specimens, and to Mr. Allen and the Rev. J. Kenrick for their interesting papers.

Mr. T. S. Noble seconded the motion, which was carried.

The meeting shortly afterwards separated.

BRISTOL MICROSCOPICAL SOCIETY.

NOVEMBER 17TH.—Mr. W. J. Fedden, president, in the chair. The formal business having been transacted, the Rev. W. Whiting, M.A., made a communication to the society "On a Method of Illustrating Lectures with Microscopic Objects."

December 15th.—Mr. W. J. Fedden, president, in the chair. The minutes of the last meeting having been read and confirmed, the evening was spent in examining various objects exhibited by the members.

The president showed the circulation in *Daphnia pulex*, specimens of calcareous sand from Suez, and an injected preparation of a portion of the tongue of Dr. Thudicum's trichinous rabbit.

Dr. Hudson—The effects produced when heated glass is examined by polarized light; specimen of a starfish, *Ophiocoma*, with the dark stop.

Mr. Lant Carpenter—The crystallization of fatty acids under the microscope.

Mr. Tibbitts—Specimens of brain and nerve tissue.

Mr. F. R. Martin—Vegetable alkaloids, including *Thebaine*, sulphate and muriate of strychnine, &c.; also various inert preparations.

Mr. Yabbicom—Botanical preparations and mite of the canary.

The Secretary—The parasite of the Impeyan pheasant.

RICHMOND AND NORTH RIDING NATURALISTS' FIELD CLUB.

THE monthly meeting was held in the museum on Tuesday, the 14th December, 1869. The president, Mr. Wood, F.G.S., was in the chair, and exhibited a specimen of the rare *Doryuspter Hoffmanni*, liberally presented to him by Mr. Duff, of Etherley, from the Midderidge marl slate, a fossil of great interest and beauty, and another gem added to Mr. Wood's well-known museum; a fine specimen of *Platysomus striatus*, from the same locality, sent to illustrate Professor King's monograph, proving the extreme rarity of the first-mentioned fossil; large and perfect specimens of *Psammodas porasus*, from the carboniferous limestone near Richmond; a fine drawing in the *Geological Magazine*, and specimens of the oolitic jaw of *Strophodus* enabled the president to admirably elucidate the character of this remarkable carboniferous fish; a cast of the Silurian star-fish, *Eucladia Johnsoni*, by Mr. H. Woodward, F.G.S., of the British Museum.

A fossil of an uncertain nature from our carboniferous rocks, but well known to palæontologists, was sent by Mr. Alderson, of Stanwick.

The president stated that he had already sent this form for the decision of the Earl of Enniskillen as to its order.

Shells and plants from the Yorkshire coal-field by Mr. Varey, proving the freshwater formation of our coal-basins; *Lithostrotion irregulare*, from the mountain limestone of Richmond, by "Flint Jack."

A millstone grit specimen of *Stigmaria*, now admitted to be the root *Sigillaria*, showing the wonderful spine-like character of its rootlets, by Dr. Armstrong.

Mr. Stubbs, of Ripon, presented black oak from a viaduct at Fountains Abbey, and from the wreck of the *Royal George*, as well as a piece of timber bored by *Terredo* which caused an animated discussion.

Mr. Cowling, jun., sent cases of local captures of *Lepidoptera*.

The great object of interest was an admirably preserved specimen of a locust (*Locusta migratoria*), taken in Richmond; these will remain in the museum for some days.

A charmingly illustrated book of water-colour drawings of flowers, cut out, and mounted on dull black, by a well-known lady *savant*, elicited much admiration.

Garnets and strontianite, from Loch Sunart, Argyllshire, were presented by Mr. March, the secretary.

Pecten æquivalvis, from the ironstone of Cleveland, by Mr. Todd.

Sixty well-arranged sheets of British plants, many from the Isle of Wight, by Mr. Ward, V.P., which he has contributed to the museum.

The president congratulated the members upon this important addition to the valuable collection of dried plants already in the possession of the club from this well-known botanist. This more than usually interesting meeting was closed by the election of new members and the passing of votes of thanks to the donors and the president.

NORTH STAFFORDSHIRE NATURALISTS' FIELD CLUB.

THE first meeting of the members of this club for the winter season was held at the North Staffordshire Railway Hotel, Stoke, on Thursday evening, Dec. 16th, and was well attended, notwithstanding the disagreeable state of the weather.

Mr. R. Garner, who presided, delivered an interesting address. He spoke of natural history as a comprehensive science which had reference to all that the ocean contained that was alive, all that was on the surface of the earth which had life, either animal or vegetable, and all that the bowels of the earth contained which had life. Time entered into the consideration of naturalists as well as space, because it bore upon many of the most interesting problems of natural history, particularly of geology. Ladies had been useful allies of gentlemen in considering questions relating to natural history, and he was glad to say took an interest in, and attended the meetings of their club. Remarking upon the object of their meeting, he said it was desirable that they should combine instruction with amusement. It was no doubt a delightful thing to admire a picture or listen to the strains of music, and he for one was not insensible to the beauties of poetry, but he could not allow that natural history was less important than painting, music, or poetry. The studies of naturalists were of a more intellectual character than mere painting. Mozart was a great composer, but he was instinctively a musician, and he was less intellectually great than Huxley and Owen. Mr. Garner dwelt upon the labours of geologists, and instanced the success of Mr. Ward, of Longton. He then commented upon the various objects of interest which had been met with by members of the club in their summer excursions, observing that it was evident one great plan pervaded all animal bodies, and that it was only reasonable to say that they were all made by one Creator. He alluded to the antiquity of the fossil tree found in Mr. Stevenson's pit at Hanley, which he said was well described by Mr. Davis a short time ago. After speaking of the study of insects as being a most delightful occupation, he mentioned that a curious little animal was found some time ago by the Rev. A. Clarke at Bagnall. It had not a particle of hair on it. Dr. Gray, of the British Museum, a very eminent man, to whom it had been sent, said he had never seen such a specimen of the shrew mouse, which was exactly similar to what was sometimes found amongst the common field mice. He mentioned that a beautiful little green lizard, which he brought from Covent-garden, was placed in his greenhouse. It escaped, and was found in a hole near his house, after being absent two winters, showing that it was possible for it to be naturalized in Staffordshire, at any rate in mild winters. He then directed attention to several objects of interest on the table before him.

Mr. G. A. Slater, of Burslem, next gave a description of a specimen of a substance found in Derbyshire, which he had named "Garnerite," a variety of sulphate of barium.

Mr. Ward, of Longton, followed with a description of some fossil remains of fish found at Fenton Park.

The meeting then spent some time very pleasantly in examining numerous fossils and other articles of interest; and it was decided to invite Mr. J. E. Davis to preside at the next meeting of the club.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

ORDINARY MEETING, DECEMBER 14TH, J. P. Joule, LL.D., F.R.S., &c., president, in the chair. Sir Charles Lyell, Bart, LL.D., D.C.L., F.R.S., &c., and Henry Clifton Sorby, F.R.S., F.G.S., were elected honorary members of the society. Mr. Robert Routledge was elected an ordinary member.

Mr. William Boyd Dawkins, F.R.S., exhibited some old mining tools, brought over by Mr. Bauerman from the turquoise-mines of the promontory of Sinai, consisting of a stone-hammer and rude splinters of flint. The turquoises occur in a bed of a quartzose mottled sandstone in Wady Sidreh and Wady Maghara, in joints running for the

most part north and south. They were worked, according to the evidence of the hieroglyphic inscriptions on the rock, by the Egyptians from the third to the thirteenth of the dynasties mentioned by Manetho. In and around the workings there are still the tools with which they were carried on. Innumerable splinters of flint, with their points blunted and rounded by use; stone hammers, some of which are broken; and rounded pebbles with a concavity on each side caused by the friction of the thumb and finger charged with particles of sand, and segments of small wooden cylinders, lie together. The flint flakes exactly coincide with the grooves in the rock made in the excavation, and evidently have been blunted by such use. The fragments of wooden cylinders are believed by Mr. Bauerman to have been portions of the sockets into which the flakes were fitted. The round pebbles were probably used for driving the rude chisel formed by the flint inserted into the wooden socket, while the large stone hammers were used for breaking up the rock. There was no evidence that metal of any kind was used in the work. Mr. Bauerman also satisfied himself that the hieroglyphs were cut with implements similar to those used in the mining. This discovery is very important, because it opens up the question as to what tools the Egyptians used in working their wonderful monuments of granite and syenite. If it were worth their while to conduct turquoise-mining with flint flakes in the Sinaiitic promontory, and if they used the same tools in the hieroglyphs that fix the date of these mines—and of this there can be no reasonable doubt—it is very probable that they employed the same means for the same end elsewhere, and that, to say the least, a part of their marvellously minute sculpture in Egypt has also been wrought with flint. There is no evidence that they were acquainted with the use of steel. Iron and bronze are not hard enough for the purpose. The minute and delicate sculpture left behind by the Mexicans, which can be proved to have been worked with stone tools, adds to the probability of this view.

"On the Hades, Throws, Shifts, &c., of the Metalliferous Veins of the North of England," by Mr. J. Curry, of Boltsburn, Eastgate, county of Durham; communicated by E. W. Binney, F.R.S., F.G.S.—That part of the lead-mining district of the North of England, to which the author's observations on vein phenomena more particularly apply, is situated on the eastern slope of the Pennine chain, and includes Alston Moor, East and West Allendales, Derwent, Weardale, and Teesdale. Millstone grit caps most of the ridges in this area, but the principal strata are of the carboniferous limestone formation, and consist of alternating limestones, sandstones, and shales, with an intercalated bed of basalt. (Whin Sill.) The chief ore-bearing series of strata is stated as overlying this basaltic bed. After making a few remarks on the prevalence of veins in this area, and on their bearings and widths, he describes and illustrates the characteristics of hades, throws, shifts, and bent positions of strata, in connection with veins. Hades are greatest in shales, or argillaceous strata. It is found, especially in the Alston Moor district, that the throws and shifts are greatest at and near the surface, and that they diminish in descending into the earth. This is probably the case with the bent forms of strata.

The new views, contained in this paper, are embraced under the consideration that the hades, throws, shifts, &c., may have been chiefly accomplished by peculiar modes of depositing of the sediments, during the contemporaneous building of the veins and strata. Such modes are minutely described and illustrated by diagrams, which are requisite to convey a clear conception of the processes.

The contemporaneous building of the veins and strata is assumed as commencing from straight fissures on the granitic floor, at the bottom of the ocean. Such fissures are viewed either as occasioned by real breaches of the solidified granite, or as effected partly by interchanges between the internal heat and that on the bed of the ocean. The heat eliminated from these fissures, and from the fissure-like vein structures, gives rise to a series of marine currents, that control the sedimentary deposits, in such a manner, on the sides and on the tops of the building veins, as to produce the varied phenomena connected with veins, namely, hades, throws, shifts, and bent positions of the strata.

In a brief abstract, like the present, the author's ideas respecting the causes productive of the vein phenomena under question, cannot be satisfactorily shown without the aid of diagrams, but the following may suffice. Veins, in general, most probably take the directive tendency of their hades from, and in agreement with the original fissures from which they build. Thus, one building from a fissure, which has a north and south course, and which hades over to the east at the top, may, in all likelihood, continue hading over to the east during its upward construction. While building, during the deposition of a shale stratum, the eliminating heat will, at the top of the underlying cheek, show much force, by driving the loose light particles back, and, consequently, cause the aggregating mass to form and face back from the perpendicular. Should the next be an arenaceous deposit, then the sedimentary particles would be heavier, so that the power of escaping heat, at the top of the underlying cheek, would not be so effective in forcing them back, therefore, the face of the aggregating arenaceous mass would form nearer the perpendicular. Thus the different hades in the varied deposits may be accounted for.

Throws are described as being due to a thicker deposit taking place on one side of a vein than that on the opposite side. The north and south vein, just cited, will answer to show the mode of explaining the throws. The rising of heated water, from the top of the fissure, would not only oppose the falling of the sediments, but would collect and carry them upwards and away from the perpendicular to the east. The sediments, thus gathered and lifted, would fall on the underlying side of the fissure. Under such conditions, the underlying side would build up faster than the overhanging one, and would, after a period of continued deposition, attain a higher level. This higher level of the underlying side is in agreement with a very general law respecting metalliferous veins and faults. Thus throws may begin at nothing, in deep-lying rocks, and continue to augment upwards until they ultimately become very considerable.

Shifts and bent positions of the strata, like the throws, are considered as beginning from nothing, and as being mostly accomplished during the contemporaneous building of the veins and strata. Without the aid of diagrams, justice can scarcely be done to an explanation of the mode of operation; but the most noteworthy characteristic conditions are, the powers of evolving heat along the courses of the several veins, and the agencies of numerous complex marine currents.

PHYSICAL AND MATHEMATICAL SECTION.

DECEMBER 7TH. — E. W. Binney, F.R.S., F.G.S., president of the section, in the chair. "On the Mean Monthly Temperature at Old Trafford, Manchester, 1861 to 1868, and also the Mean for the Twenty Years 1849 to 1868," was an interesting metereological paper, accompanied by numerous tables, by G. V. Vernon, F.R.A.S., F.M.S.

EDINBURGH BOTANICAL SOCIETY.

THE society met on Thursday, 9th December, at 5, St. Andrew-square—Sir Walter Elliot, the newly-elected president, occupied the chair. The following communications were read:—"On the Structure of a Lignite from the Old Red Sandstone," by W. R. M'Nab, M.D. Edinburgh. "Histological Notes," by W. R. M'Nab, M.D. Edinburgh.

"Notice of *Hieracium stoloniflorum*, Waldst. and Kit.; *H. glomeratum*, Fr.; *H. præaltum*, Vill., as occurring in the neighbourhood of Edinburgh," by Professor Balfour. Professor Balfour gave descriptions of the above three species of Hieracium, which had recently been met with, growing in a wild state in the neighbourhood of Edinburgh. *H. præaltum* was collected by Dr. John Kirk, in 1854, near Kincardine, in Fife; *H. glomeratum*, by Mr. John M'Laren, in June, 1869, growing on railway banks between Edinburgh and Granton; and *H. stoloniflorum*, collected by himself and Mr. Sadler, in October, 1869, on the railway banks between Warriston and Trinity. Specimens were exhibited and presented to the Herbarium.

"Notice of Additions to the Botany of Shetland," since the publication of Edmonston's "Flora," by Mr. John Sadler.

"On the Propagation of the Ipecacuan Plant (*Cephaelis Ipecacuanha*)," by Mr. John Sadler.—The Ipecacuan plant has recently been attracting much attention from the belief that it will become, like the Cinchona, a profitable plant to cultivate in various districts of India. The *Cephaelis Ipecacuanha* is a native of the moist woods of Brazil, and was first introduced into the British gardens in 1830. It is a plant of remarkably slow growth. The largest now in the Botanic Gardens is scarcely one foot in height, although more than thirty years of age. The method hitherto adopted for propagating the Cephaelis (as far as I am aware) is by cuttings, but of these not more then one or two can be got at a time, and at very long intervals. By this slow method of propagating, the Cephaelis must always remain exceedingly scarce.

The roots, or rather rhizomes, of the Cephaelis are moniliform. A few of these were taken from one of the plants in the Botanic Garden during the month of August, 1869, and after being cut into small transverse sections, they were inserted in a horizontal position over the surface of a pot prepared with drainage and white sand. This pot was placed under a hand-glass in a warm propagating bed and kept moist. A few weeks after, the cuttings showed buds on the upper side, roots being also sent out from the under surface. The plants are now beginning to grow, each being furnished with two leaves, the largest measuring ¾ of an inch over. In order to meet the demand, which, in all likelihood, will be made on nurserymen for plants of the Cephaelis, it is well to know how it can be propagated independently of cuttings, and at the same time without injury to the parent plant.

"Notes on the 'Dogwood' of Powder Manufacturers," by Mr. M'Nab.

"Notice of *Ruscus aculeatus*," by Mr. M'Nab.—Mr. M'Nab exhibited a specimen of the *Ruscus aculeatus*, or Butcher's Broom, covered with rich crimson berries, sent by George E. Frere, Esq., of Roydon Hall, Diss, with the following letter:—"Some years ago, I found this plant in a state of ripe fructification. It is brought every Christmas into the market at Brighton, for the

decoration of houses at that season. I had never seen before, in any other part of England, more than one, or, at most, two berries in any one clump of the plant, and I wished very much to get it to fruit in profusion at this place. I was reminded that the plant was dicecious, and I found friends to supply me with female plants. Soon after I received them it was suggested to me that my plants might possibly not have been hitherto barren because they were of the male sex, but for want of impregnating agencies. I saw, a day or two since, an article in a new scientific journal, by A. W. Bennett, who calls attention to the fact, that the normal time of flowering of the plant is almost the depth of winter, when the number of insects that can assist in its fertilization is certainly very small. Mr. Bennett also remarks on the incorrectness of the periods generally given in the text-books of botany for the flowering of each species. Hooker, in his *British Flora*, and Sowerby, in his original edition of *English Botany*, give March and April for the flowering of this plant."

Mr. M'Nab mentioned that, although several large clumps of Butcher's Broom exist in various parts of the Botanic Garden, he had never seen ripe fruit on any of them. All the plants but one have a dark green colour, all are very compact, and are now covered (8th December, 1869) with rudimentary fruit buds, but no male flowers have yet been obtained. The one above alluded to, a tall light green variety, has a few incipient scales on the side of the leaf. This may be the male plant, but as it is not growing beside what is undoubtedly the female plants, no seeds could be perfected. The specimen sent by Mr. Frere, although containing numerous ripe berries, has also a number of apparent rudimentary fruit buds for next year, similar to those now seen on the plants in the garden. It is difficult to say at what stage the impregnation of the ovule takes place. The plant is recorded as dicecious, and flowers during March and April, and possibly this is the time when the male blossoms expand. It will be interesting to ascertain whether these rudimentary fruit buds, now covering the plants, remain as they are till the month of March, when the male flowers expand.

I have just received from the nursery gardens of Messrs. P. Lawson & Son, two specimens of Ruscus, one called *R. aculeatus*, and the other *R. aculeatus rotundifolius*. The former is identical with the one cultivated here, and is also covered with rudimentary female flowers. The specimen called *R. aculeatus rotundifolius* is also covered with buds; but after a careful microscopic examination, all turn out to be male buds, while the specimen sent from England, by Mr. Frere, has male buds and ripe fruit on the same branch. From the state of the male buds on both plants alluded to, it seems impossible that these male flowers can have the stamens sufficiently developed before March or April.

"Notes on *Carex paniculata*," by Mr. M'Nab.—The Royal Botanic Garden has recently been presented with three plants of *Carex paniculata*, sent by Mr. Archibald Gorrie, forester to the Earl of Leicester, Holkham Hall, Norfolk. The plants measure, from the base of the roots to the extreme points of the leaves, 8 ft. 6 in., independent of what must have been cut off in the lifting. They have been growing in deep rich soil, as 3 ft. of the lower portion of each has been bared of the peat; the part remaining is filled up with a mass of longitudinal roots or fibres, each nearly ½ in. round.

The circumference of the upper root portion of the largest plant is 5 ft. 3 in. wide, from which a large crown of leaves proceeds. One of the plants has an upright stem above the peat, 1 ft. 9 in. long, and 3 ft. 6 in. in circumference, composed of the dead portions of the leaves; from the top of this pseudo-stem the large tuft of leaves is growing. The stem of this plant between the leaves and the peat has the lower base of the fallen leaves quite short and brown, appearing as if they had been destroyed by fire.

It is impossible to guess at the age of these gigantic sedges; but, judging from the quantity of decayed leaves round the base of each plant, and the way the peat seems to grow or rise round them, they must at least be a century old. Very few fruit spikes were observed, and of those found, the heads were comparatively small, the largest not more than 2½ in. long. Some idea may be formed of the size and weight of these plants from the fact that it required three men to lift each of them.

Mr. Gorrie writes: "We have some taller and heavier plants than any of those sent. I observe they grow strongest when the roots get into the water. I am told, when foxes abound, they are very fond of lying on the top of the Carex tussocks, and basking in the sun. This gigantic Carex is very common on sodden peaty soils in Norfolk. I have also seen it at the Duke of Grafton's, and at other places in Suffolk, likewise near Bury St. Edmunds."

"Notes on *Pinus Benthamiana*," by Mr. M'Nab.—Mr. C. W. Peach, of Haddington-place, Edinburgh, exhibited a large cone, ripened at Overton, Orton, Peterborough, the seat of Charles Bodger, Esq., under the name of *Pinus macrocarpa*. This cone is 6½ in. long and 14 in. in circumference. Mr. Bodger writes:—"The tree stands in the centre of my garden. It bore three drooping cones in 1868 on the main stem, where that season's wood shot from; no signs since of any more; it has made two shoots from branches since the cones were taken off, one each season. There are twenty-three spreads of branches from the main stem. I believe it has been planted where it now stands for twenty-two or twenty-three years. The tree is 34 ft. in height, and 23 ft. across the branches. The circumference of the stem at the surface of the ground is 4 ft." *Pinus macrocarpa* is by many considered as synonymous with *Pinus Coulteri* and *P. Sabiniana*. The cone sent by Mr. Peach agrees with the description of *Pinus Benthamiana*, of Hartweg, which we have never seen in cone. Numerous plants are cultivated throughout the country raised from cones introduced about eight years ago, under the name of *Pinus Benthamiana*. The cones were 4½ in. long, and 7 in. in circumference. The habit of the plants, and the size and arrangement of the leaves of many of them, resemble the true *Pinus Benthamiana*. It is not improbable that all will turn out to be *Pinus ponderosa*, or a variety of it. In all cases a few cones ought to be sent home with seeds for identification.

Exhibitions and Presentations.—Major Peploe exhibited and presented a cone of *Pinus Sabiniana* produced this season at Garnston. Mr. Gorrie, forester to the Earl of Leicester, exhibited and presented cones of *Cupressus Goveniana*, and male and female cones of *Araucaria imbricata*, produced at Holkham Hall, Norfolk. Mr. Gorrie also exhibited a section of a stem, showing a graft between *Quercus Aesculus* and the common oak, the former being the graft. The graft had increased to 23 in. in circumference, while the attachment was very limited. When blown down during a recent gale, it was found that the stems had only adhered to each other by a small portion of the wood and bark. Mr. C. W. Peach exhibited a collection of Shetland plants, a twin apple, and specimens of dandelions with double heads of flowers, and leafy appendages on the flowering stalks. Prof. Dixon exhibited, under the microscope, preparations of the drupe of *Viburnum lantane*, and made some remarks regarding its structure. Prof. Balfour exhibited photographs of Indian forest scenery, including palms, banyans, &c., sent by Professor Stephen Coull Mackenzie, Calcutta. Mrs. Wright presented a specimen of *Lythrum flexuosum*, which had been gathered in the woods at Haliston, Shropshire. Mr. A. Craig Christie exhibited a specimen of *Argemone odorata* collected by the waterfall in Glen Easdale, Arran; and also a specimen of Hypericum from Birk Glen, Arran, which was considered a variety of *H. Androsœnum*.

GLASGOW NATURAL HISTORY SOCIETY.

The fourth meeting of this session was held on Tuesday evening, the 28th December, in the library of Anderson's University, Mr. David Robertson, F.G.S., one of the vice-presidents, occupying the chair. The following gentlemen were elected members of the society:—Messrs. John Cook, 71, South Portland-street, and Charles Young, 4, Great Kelvin-terrace, as resident; and Mr. George S. Brady, C.M.Z.S., Sunderland, as corresponding.

The secretary exhibited a specimen of the Brown Snipe (*Macrorhamphus griseus*, Gmelin), and a specimen of the Green-rumped Tatler, or Solitary Sandpiper (*Totanus chloropygius*, Viellot), regarding which he read a communication from Mr. Francis M'Culloch, taxidermist, 20, Sauchiehall-street, giving satisfactory evidence of the birds having been shot in Lanarkshire. The brown snipe had occurred in Scotland before, but the sandpiper had not previously been found in Europe. It is a well-known species in North America, frequenting pools of water, and also the banks of rivers at a distance from the sea. Both birds had been procured by the late Wm. Gordon, of Airdrie, who was well known to Mr. M'Culloch, and who had frequently referred to the birds as belonging to a species that he could not identify. His death in August last had prevented any information being obtained as to the exact locality in which they were killed, but so far as Mr. M'Culloch recollects, he spoke of having met them beside a freshwater dam near Airdrie, on the banks of the Clyde.

Mr. Gray also exhibited a specimen of the Shoveller (*Anas clypeata*), a beautiful male, which was shot a few weeks ago, and forwarded by Mr. William Lorrain; also an immature male specimen of the Little Gull (*Larus minutus*), which was shot in March last near Aberdeen. Mr. Gray mentioned that his friend, Mr. Angus of that city, had obtained at various intervals a number of specimens of this rare British bird—three of which had come into his hands only a few weeks ago. It would appear, indeed, that in its movements southwards this species passes along the coasts of Aberdeenshire almost every winter.

Mr. James Coutts exhibited a very pure albino of the common lark, from Ballantrae, in Ayrshire. This specimen was quite spotless, and without the faintest trace of any tint on the plumage.

The Rev. James E. Somerville exhibited a skull of the hog-deer (*Babyrussa alfurus*), and made some remarks on the geographical distribution of this curious animal.

The following papers were then read:—

"Notes on *Cypris lævis* and its habit of Perforating the Leaves of *Victoria regia*," by David Robertson, Esq., F.G.S., vice-president.—In this paper, which was illustrated by specimens of leaves and microscopic preparations, Mr. Robertson made this important disclosure, that the failure that has taken place of late years in the cultivation of this

beautiful plant in the Glasgow Botanic Garden is attributable to the presence of a small Entomostracan in the tank in which the plants are reared. This almost microscopic animal exists in millions, and at the time Mr. Robertson's attention was first drawn to them by Dr. Colquhoun in June last had swarmed to such an extent as to impart a strong brownish tint to the water. The leaves of the *Victoria regia*, when examined, were found to be pierced with innumerable holes, in many of which Mr. Robertson had found the eggs of the *Cypris lævis* deposited, showing that the attacks of the creature may have been made, not for the object of feeding on the leaves, but to prepare a receptacle for hatching purposes. But apart from the precise object, there could be no doubt that the holes pierced through an otherwise healthy plant had induced further decay, as could easily be observed by watching its progress. An experiment had been tried by Mr. Bullen, the curator of the garden, which had resulted in the almost total annihilation of the Entomostraca, and consequent revival of the health of the plants, and this was looked upon as a proof that the previous difficulty, or rather impossibility, of continuing the successful cultivation of the Victoria plant, for which the Glasgow Botanic Garden had long been celebrated, was clearly traceable to the presence of these destructive creatures. Mr. Robertson dwelt on the fact that the temperature of the water may have caused the excessive increase of the Cypris in the tank, and suggested as a remedy that when the tank was next emptied and cleaned, a piece of gauze should be placed on the mouth of the pipe supplying the water so as to prevent the ingress of the Entomostraca, and by this simple means secure a healthy plant that would again delight visitors by displaying its beautiful flower.

The reading of this paper was followed by an interesting discussion, in which Mr. John Young, Mr. James Ramsay, and several other members took part, and at its close a cordial vote of thanks was tendered to Mr. Robertson for the care and painstaking with which he had conducted his researches.

"On the Present Distribution of the Capercailzie in Scotland," by the secretary, Mr. Gray.—Various localities were enumerated in which this "chieftain of the grouse tribe" had of late years become established in Scottish woods and forests—Perthshire and Forfarshire being looked upon as its principal strongholds. Stragglers, however, had been recently met with as far south as Galloway and Dumfriesshire, and it had occurred also on Auchengray Moor, near Airdrie. These birds were probably wanderers from the woods of Sanquhar, where the species was known to have been introduced from the island of Arran, a few years ago. Mr. Gray likewise stated that in some parts of Perthshire it was no uncommon thing for shooting parties to be allowed to make up their bag with as many as 12 or 15 braces of capercailzies in a day. On the estate of the Earl of Breadalbane they could now be shot in considerable numbers without fear of injuring the breed.

The librarian announced as a donation to the library Dr. T. Spencer Cobbold's work on *Entozoa; an Introduction to the Study of Helminthology;* in 2 vols. 8vo., plates, 1864, and supplement, 1869, from James Stewart, Esq.; after which the society adjourned till the last Tuesday of January.

CORK CUVIERIAN AND ARCHÆOLOGICAL SOCIETY.

The third meeting of this society for the session 1869-70 was held in the library of the Royal Cork Institution, on Wednesday evening, December 1, James Butler Brennan, Esq., V.P., in the chair. Dr. R. Caulfield exhibited a tracing of a crannog, or lake-dwelling, which he had made from a manuscript volume of ancient Irish maps and drawings, preserved in the Public Record Office, London, and beautifully executed on large sheets of vellum. His attention had been called to this collection in July last, by Mr. Hans C. Hamilton, The plans appear to have been made about the year 1609. The crannog in question is called the "Forte of the Eogher." The island on which it is constructed is an irregular parallelogram. Its margin is closely fringed with pointed stakes, through which rivets are driven so as to secure others. These double stakes are fixed on the north and west and part of the east side, while a strong castle with a rampart stands on the south. A causeway similarly fortified with sharp stakes runs from the land into the middle of the island on the west. Within the island are residences resembling thatched cottages, and from the south-west angle a piece of ordnance projects. This plan is extremely interesting, as showing the progressive development of lake-fortresses from an early period down to the beginning of the 17th century. In the *Annals of the Four Masters*, we have frequent mention of these crannogs, viz., under the years 1247, 1436, 1452, 1455, 1500, and even down to the year 1603. Crannog is derived from the word *crann*, which signifies trees, the trunks of trees being driven down into the mud, on which planks were placed, and on these the rude dwellings of the inhabitants.

Mr. Robert Day, jun., F.S.A., exhibited the following:—An oval pierced hammer, of quartzite, from Island Magee, co. Antrim; a boat-shaped pierced hammer, of sandstone, from Denmark, and one of felspar, diamond-shaped, from Sweden; these are all highly finished and well preserved. Also, from Denmark, a flint chisel, 8 in. long by $\frac{5}{8}$ in. wide, polished on four sides; and a flint gouge-shaped implement, with a fine cutting edge. This and the chisel may be assigned to the later stone period, and the hammer to the early iron age. He also showed some bronze implements and weapons from Ireland, among which were a chisel of great rarity, a leaf-shaped dagger, 8$\frac{1}{2}$ in. long, having two large bronze rivets for hafting; a socketed five-spear head, 11$\frac{1}{2}$ in. long, with loops in the lower parts of the blade. Both these weapons are from Rushmills, co. Antrim. He also exhibited a winged palstave, or adze, from Coote Hall, co. Roscommon, and another from Dublin.

BELFAST NATURAL HISTORY SOCIETIES.

At the joint meeting on Wednesday, December 1, Mr. Joseph John Murphy read a paper on "The Origin of Organs of Flight."—Though not an adherent of Darwin, he took the development theory as proved, and proceeded to apply it to the organs of flight. Perfectly developed wings were found in four classes of animals—bats, birds, pterodactyles (a race of flying reptiles found only in the fossil state), and insects. But there are races having an imperfect power of flight by means of membranes stretched along their sides which serve as parachutes, and by means of which they take long, gliding leaps. The flying squirrel is one of these, the flying opossum another, and the flying lemur a third. Specimens of these from the Queen's College Museum were exhibited. Mr. Murphy agreed with Darwin that the origin of the bat's wing was probably such a membrane; and he thought the same of the pterodactyle. Specimens belonging to the Belfast Museum were exhibited of the draco, a small lizard which has a somewhat similar membrane, and uses it in the same way. Mr. Wallace has lately discovered in Borneo a tree-frog which has the same power of gliding through the air by means of its enormously large webbed feet. All these gliding animals inhabit trees, and it is a life among trees that makes their power of taking very long, gliding leaps of use to them. The flying-fish is another animal with imperfect power of flight, but it is not a gliding animal; according to Mr. Wallace, an excellent observer, it really flies. Birds have no vestige of a side membrane, and therefore most probably never were gliding animals, but moved their wings from the first; as also did insects.

FOREIGN ACADEMIES.

Paris, December 27th.—M. Bernard presided. The correspondence was presented by M. Dumas.

Notes were sent in on the following subjects:—A geological map of Pays-Bas. On paludal fevers, on the true direction of the magnetic needle on board ships, on the detonating compounds produced by the action of common gas on salts of copper.

A memoir was presented by M. Decaisne on lactation.

M. Lacaze-Duthiers sent in a paper on the morphology of mollusks, in which, by a study of the nervous system, he has been enabled to lay a basis for philosophical classification.

In a note on rosolic acid, a derivative of aniline M. Guillot states that this substance is not poisonous.

M. Roger presented a note on the influence of nascent hydrogen on the transformation of organic bodies.

M. Deherain presented a note on the migration of the immediate principles in herbaceous plants, and on the formation of starchy compounds in the grain of corn.

A letter was read from M. Isidore Pierre confirming M. Péligot's views on the function of salts of potash on the nutrition of plants.

Dr. Phipson sent in two notes on two new substances recently obtained by him.

A work was received from Professor Sterry Hunt on the chemistry of copper, and especially on protochloride of copper compared with chloride of silver.

M. Dumas, in the name of M. Feil, presented specimens of Faraday's "dense glass" obtained in the ordinary process of glass manufacture, and which, being almost colourless, might be employed for optical purposes, since the method of manufacture is much cheaper than that hitherto employed. M. Feil obtained other specimens of even greater specific gravity than the dense glass of Faraday, but, unfortunately, they were coloured. M. Dumas stated that the same manufacturer had obtained artificial gems, which have so many of the properties of the natural ones that they may be advantageously employed in jewellery. Specimens of various silicates and aluminates thus obtained were exhibited.

M. Becquerel stated that, twenty years since, M. Gaudin had by means of the blow-pipe flame obtained results similar to those above. Some of the silicates and and aluminates had not a trace of alkali and could hardly be distinguished from the natural stones, diamond excepted.

General Morin then gave an account of the recent experiments in Cinchona culture in the Isle of Réunion. The seeds germinated well, but when the young plants were bedded out in the plains they did not thrive; those, however, which were planted on more elevated sites—at a height of 1,200 mètres got on capitally, so that after a few months they attained a height of from four to five mètres. Hence this experiment must be regarded as perfectly successful.

M. Delafosse then gave an account of the mineralogy of Russia.

M. H. Saint-Claire Deville gave a sketch of the progress of the meteorological observatory of Montsouris. Work is being done daily, but many of the instruments are as yet without proper shelter, but it is hoped that measures will soon be taken to remedy this state of things.

M. Bussy presented a note from M. Personne, pointing out that experimenters with chloral should not consider as identical, the hydrate of chloral obtained by his process and the chloral obtained by M. Roussin by a different method.

M. Milne-Edwards presented a second note from M. Balbiani on the embryogeny of the *Sacculinæ*.

M. Faye then quoted Genesis to show that the word mule was so employed that it was impossible to mistake its signification: hence he concludes that at the period referred to, the horse must have existed in Egypt.

The Academy then resolved itself into a secret committee.

SOCIÉTÉ PHILOMATHIQUE OF PARIS.

DECEMBER 11TH.—At this meeting M. Paul Bert presented a most interesting paper on the influence of light on the sensitive plant. It showed that the effects of intense illumination and intense obscurity, while they are the same in the paralyzing effect as to motion, differ diametrically as to the paralysis of sensibility of the petioles.

REALE INSTITUTO LOMBARDO.

MILAN, NOVEMBER 25TH.—The meeting was under the presidency of Signor Brioschi.

The vice-president, Dr. Castiglioni gave an account of the method employed in the education and instruction of deaf mutes.

Prof. Porta read the first part of his memoir on the ligature of the large arteries.

Prof. Garovaglio, on the part of his colleague, Prof. Gibelli, gave an account of the species of the genus, *Endocarpon* of central Europe and Italy. His memoir contained figures of various of these lichens.

A paper by Dr. Valsuani on puerperal cachexia was next read, and, at the suggestion of Dr. Verga, was ordered to be published.

Signor Verga then gave an account of some recent experiments carried out at Milan on the subject of chloral. The writer enters upon a consideration of the opinions of MM. Liebreich and Demarquay.

Prof. Cantone gave an interesting sketch of the results of certain experiments on heterogeny made by himself and Prof. Maggi. The experiments were conducted in flasks hermetically sealed, and at a temperature of as high as 105° Cent.

Dr. Bizzozero communicated a note by Dr. G. Milani, on a peculiar pathological alteration of the lymphatic glands. This alteration seems to consist in the deposition of pigmentary matter and the formation of a stroma of protoplasm.

SCIENTIFIC OPINION was then presented to the Institute, and the meeting terminated.

ACADEMY OF SCIENCES, VIENNA.

DECEMBER 9TH.—This meeting of the Natural and the Mathematical Sciences Class was devoted almost entirely to mineralogical matters. The first paper was by Dr. L. J. Fitzinger, and was a continuation of his memoir on bats; the horse-shoe bats, or Rhinolophi, being those dealt with in the present part. He has already dealt with the genera *Cœlops*, *Phillorhina*, and *Asselia*.

Herr Tschermak sent in a paper on the characters and relations of the plagioclastic felspars. In this he gave an account of some microscopical observations, and dealt with the opinions of Miller, Des Cloizeaux, and Vom Rath.

Herr Dr. J. Peyritsch read an important memoir on the morphology of the floral organs of the Umbellifera, more especially the following species: *Carum carui*, *Daucus carota*, *Torilis anthriscus*, and *Peucedanum chabræi*.

Herr Custos Schrauf read a note on the character and distribution of Brookite.

NOTES AND MEMORANDA.

Friday Evening Discourses at the Royal Institution, in 1870.—January 21st, "On Haze and Dust," by Professor Tyndall, LL.D., F.R.S., M.R.I. January 28th, "On Professor Graham's Scientific Work," by Professor Odling, F.R.S. February 4th, "A Talk respecting Verona and its Rivers," by Professor Ruskin, M.R.I. February 11th, "On Temperature and Life in the Deep Sea," by W. B. Carpenter, M.D., F.R.S., &c. February 18th, "On Theories of the Physical Forces," by William Kingdon Clifford, Esq., B.A. February 25th, "On the Results of the Excavations at Jerusalem, and on the recent Survey of Sinai," by Colonel Sir Henry James, F.R.S. March 4th, "On Ironclad Ships," by E. J. Reed, Esq., C.B., Chief Constructor of the Navy. March 11th, "On Chance," by Professor Sylvester, M.A., LL.D., F.R.S. March 18th, "On the New Thames Tunnel," by Peter Wm. Barlow, F.R.S. March 25th, "On the History of the Fourth, Fifth, and Sixth Centuries in England, as illustrated by Researches into the Modes of Sepulture then practised," by Professor Rolleston, M.D., F.R.S. April 1st, Professor Roscoe, F.R.S. April 8th, Professor Huxley, F.R.S. On April 15th and 22nd (the Fridays in Passion and Easter weeks) there will be no meetings. After Easter the Friday Evening Meetings will be resumed on April 29th, and continued till June 10th, without intermission. Discourses will *probably* be delivered by Professors Blackie, Williamson, and Odling.

Iron Stoves as Poisonous Agents.—Dr. Pidtmann, writing in *Virchow's Archiv*, does not hesitate to assume that chronic poisoning by carbonic acid is comparatively frequent in his part of the country, which is rich in iron stoves.

Opium Eating with impunity.—Dr. C. K. Ladd, of Towanda, Pennsylvania (*Trans. Penn. Med. Society*), reports the case of a man who had taken opium for upwards of fifty years, and during the last years of his life consumed three drachms each day.

The Noematachograph.—M. Donder's instrument to determine "the velocity of the physical functions of the brain" is called the *Noematchograph*, and is composed of a cylinder on which time is registered by means of a diapason making 261 vibrations in a second, and moved by electro-magnetism, on the principle proposed by Helmholtz. These vibrations can be divided into fifths, and three thousandths of a second obtained.

A New Marble has been discovered in the Giant Mountains of Bohemia, which is described as in every way equal to Carrara, both in whiteness and fineness of grain, and invaluable for sculpture or for the purpose of trade when worked into table-tops, &c.

Reactions of Morphia and Papaverine.—Herren Hofman and Schroff indicate a means of distinguishing between the two alkaloids, morphia and papaverine. The double iodide of potassium and cadmium gives with papaverine a small white precipitate, which collects into pearly scales; while with morphia, even in very dilute solutions, it gives fine crystalline needles, which are very characteristic. By a microscopic examination, these two precipitates may, says the *Pharmaceutical Journal*, be easily distinguished.

What Part of the Brain has to Do with Emotion?—Professor Jessen, in a recent memoir, concludes that there is good reason to believe that the cerebellum is more especially the organ of the emotions.

SCIENTIFIC DIARY.

WEDNESDAY, January 5th.

Pharmaceutical Society, 8 p.m. "Notes on the Pharmacopœia," by Professor Redwood. "On Syrup of Iodide of Iron and Diluted Nitro-Hydrochloric Acid," by Mr. Porter, will be discussed and illustrated. "Liquor Magnesiæ Carbonatis," by Mr. Humney. "A Table of Strength of various Specimens of Fluid Magnesia," by Professor Attfield.

Royal Society of Literature, 8.30 p.m.

Obstetrical Society, 7 p.m. Special council meeting. 8 p.m., Annual meeting. "On the Early Use of the Long Forceps," by Dr. F. Daly. "On the Sulpho-Carbolates in the Treatment of certain Diseases of Children," by Dr. A. E Sansom. 9 p.m., President's Address.

THURSDAY, 6th.

London Institution, 7.30 p.m.

Royal Society, 8.30 p.m. "Some Account of the Suez Canal," by J. F. Bateman, F.R.S. "On the Mineral Constituents of Meteorites," by N. Story Mackolyne. "On Fluoride of Silver," by G. Gore, F.R.S.

Royal Society Club, 6.30 p.m.

Harveian Society, 8 p.m. Anniversary meeting, President's address, and election of Officers.

Leeds Philosophical Society. "Recent Discoveries in Physical Science," by Mr. W. F. Barrett, 2nd Lecture.

Perthshire Society of Natural Science, 8.30 p.m. "The Lepidoptera of Stanley and its neighbourhood." "The Gold and Goldfields of Perthshire."
Royal Institution, 3 p.m. Dr. Tyndall's Juvenile Lectures "On Light."

FRIDAY, 7th.

Geologists' Association, 7.30 p.m. Anniversary meeting.
Old Change Microscopical Society. Professor Rymer Jones's Lectures "On Comparative Anatomy."
Social Science Association,[1] 4 p.m. Executive Committee.
Medical Teachers' Association, 8 p.m. Council meeting.

SATURDAY, 8th.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. Dr. Tyndall's Juvenile Lectures "On Light."

MONDAY, 10th.

Royal Geographical Society, 8.30 p.m.
Medical Society, 8 p.m.
Bradford Philosophical Society. Lecture "On Sound," with Experiments, by W. F. Barrett, F.C.S.
Torquay Natural History Society. "On the Progress of Science in 1869," by W. Pengelly, F.R.S.
Social Science Association, 7.30 p.m. Standing Committee of Economy and Trade. 8 p.m., adjourned discussion on Mr. E. W. Hollond's paper "On the Employment of Paupers."

TUESDAY, 11th.

Ethnological Society of London, 8 p.m. "On the Kitai and Kara-Kitai," by Dr. Gustav Oppert. "On the Origin of the Tasmanians, Geologically considered," by J. Bonwick, Esq., F.R.G.S. "On some Prehistoric Remains Discovered in New Zealand," by Dr. Julius Haast, F.R.S.
Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m.
Photographic Society, 8 p.m.
Manchester Literary and Philosophical Society, 7 p.m. Council meeting at 5.30 p.m.

WEDNESDAY, 12th.

Geological Society, 8 p.m. "On the Superficial Deposits of Portions of the Avon and Severn Valleys and adjoining Districts," by T. G. B. Lloyd, Esq., C.E., F.G.S. "On the Geological Position and Geographical Distribution of the Reptilian or Dolomitic Conglomerate of the Bristol Area," by R. Etheridge, Esq., F.G.S.
Graphic Society, 8 p.m.
Royal Microscopical Society, 8 p.m. "On the Calcarious Spicula of the *Gorgoniadæ*," by W. S. Kent, F.Z.S. "On an Undescribed Stage of Development of *Tetrarhyncus corollatus*," by A. Sanders, M.R.C.S., &c. "On a new Method of Measuring Spectra Bands," by John Browning, F.R.A.S.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.

LUNAR CRATERS AND VOLCANOES.—"W. R. B."—We shall bear your proposal in mind, and are much obliged to you for the suggestion. Are the engravings that you speak of already executed?

CURRENTS ON BREAKING CONTACT.—"Galvanometer's" letter has been placed in the hands of one of our staff, and we hope to furnish him with the reply next week.

BAPHETES AND REPTILES.—"W. S. D."—Thanks for sending the correction; it shall of course be carried in.

IS THE EARTH A GLOBE?—"J. H."—Refer to "The Week," and you will see what we have done. You are labouring under a misconception as to the influence of gravity.

SCIENCE AT CARACAS.—"A. Ernst."—We were very glad to hear from you. The *Vargasia* was placed in the hands of one of our reviewers, who unfortunately mislaid it. He has, however, discovered it, with what result you may see in our Notices of Books.

"THE UNIVERSE."—Messrs. Blackie are thanked. We will communicate with them early this week.

MR. RICKBECKER.—"J. A. H. B."—You mistook our notice. The gentleman is not in England. The communication was sent from America.

BRITISH DENTAL SCIENCE.—We are sorry that we cannot oblige our correspondent. The exchange list is so long we cannot just at present undertake to increase it.

[1] The notice received states *Wednesday*, January 7th. We presume that the "date" is correct.

WINCHESTER SCIENTIFIC SOCIETY.—"C. A. J."—If our esteemed correspondent reads "The Week" he will see that we have done all in our power to advance the interests of the Society, whose transactions we shall be happy to publish from time to time.

BRADFORD PHILOSOPHICAL SOCIETY.—"L. C. M."—We are very much obliged to you for your kind thoughtfulness. You see we have made use of the matter. Professor Huxley does not agree with you as to the "verbatim" quality.

FOSSIL PLANTS OF ST. DAVIDS.—"H. H."—Thanks for the interesting memoir. If it were not for the lithograph we should use it.

CHEAP OBJECTIVES.—"Micro."—Thanks for your good will and frequent communications. Gundlach, of Berlin, is the cheapest maker. His English representative advertises in the current No. of the *Monthly Microscopical Journal*. Mr. Crouch is also bringing out some very excellent cheap object-glasses on the immersion principle.

A CONVENIENT BATTERY.—The bichromate battery is one of the most convenient cells we know of. The elements lift up out of the liquid by a sliding bar, and even if the cell is upset, nothing escapes. As an excitant of the ordinary induction coil, especially for medical men, this battery is not to be surpassed. Mr. Apps, of the Strand, the maker of Professor Pepper's Induction Coil, has shown us some very excellent samples.

THE FROG-PLATE.—"T. B. G."—From any of the Microscope Makers.

THE COMBUSTION OF TOBACCO.—"H. W." should read an admirable pamphlet published a couple of years since. It is entitled *For and Against Tobacco*, and is by Dr. B. W. Richardson, F.R.S.

THE PHYSIOLOGY OF THE CELL.—"W. V. T." should get a book announced in our bibliography this week.

HEAVY GLASS FOR OPTICAL PURPOSES.—"Chemicus" should consult the first volume, p. 298, of *Faraday's Life and Letters*, by Dr. Bence Jones.

ROYAL SOCIETY.—"Inquirer."—The reason why we have delayed the reports was that we awaited Dr. Carpenter's Deep-sea Report, which was the first paper read this session. Strange enough, however, the first number of the *Proceedings* is now issued, and it contains all those papers which we have already had in type and have kept back, but no report from Dr. Carpenter. We presume the reason of the delay is that as the subject is one of great difficulty and importance, and as little time was allowed Dr. Carpenter for his Report, he is making those corrections, &c., which are required.

OUR NEW VOLUME.

With a view to meet the extending requirements of this Journal, we have permanently enlarged SCIENTIFIC OPINION, *and have introduced various improvements suggested by the experience gained during the production of the first two Volumes. May we ask Subscribers to remind those of their Scientific friends who are not already in the habit of regularly purchasing* SCIENTIFIC OPINION, *that the commencement of the present Volume presents a very favourable opportunity to intending Subscribers.*

NOTICES.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

Subscribers to SCIENTIFIC OPINION are informed that they can procure of the Publishers direct, or through their local Bookseller, neat cloth Cases for Binding Volumes I. and II. of this periodical, price 2s. each.

ALL persons failing to obtain a regular supply of this journal through their local agent may insure its prompt receipt upon the day of publication by forwarding their name and address to the publishers, at 75, Great Queen-street, together with a remittance in accordance with the subjoined modified scale of subscription (which includes postage), viz.—

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One Year's Subscription	0	17	6
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Subscriptions in all cases to be paid in advance.

These terms practically abolish the charge for postage, and those of our readers who have hitherto been inconvenienced by the apathy or inattention of their newsagents will henceforth be saved trouble, annoyance, and extra cost in procuring this journal.

BACK NUMBERS OF SCIENTIFIC OPINION.—It is impossible to reprint the back numbers of SCIENTIFIC OPINION, therefore subscribers should at once collect their loose numbers and bind into volumes. The Publishers will be happy to purchase, at full price, clean copies of Nos. 3 and 11 of Volume I. of this journal.

THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, JANUARY 12, 1870.

PETROLEUM LAMPS AND THEIR DANGERS.

TO our minds it is perfectly clear, as the result of recent inquiries and experiments conducted by ourselves and by others, that the existing Petroleum Act does not in any satisfactory degree protect the public from liability to grave accident. We have already pointed out the general incompleteness of legislation on the petroleum question, and we have shown how easy it is for the vendor to adopt Mr. Daniel O'Connell's suggestion to drive a coach and six through the Act. As if in confirmation of these views, expressed some months since, we have the report referred to in our last number, in which the chemist to the Mineral Oil Association shows that the operation of the statute is *nil*. Out of seventy-four samples of petroleum purchased at different London shops, one-half were found to explode at a temperature below 100°; in other words, these samples were all illegal, and the vendors of them ought, under a proper execution of the law, to have been severely punished. But of course they were not punished, though they evaded the statute, and will most probably continue to evade it, till the destruction of a few families or the burning down of half a dozen houses or so, rouses the authorities to a sense of the public danger.

But even were the Act thoroughly carried out, were we provided with a number of energetic inspectors, who determinedly went about from shop to shop taking "flashing-points," would the danger be removed? To this question we feel disposed to answer,—No. Doubtless the restriction of the use of coal-oils to those which give off an inflammable vapour at 100° Fahr. is a useful enactment, since it removes a very great proportion of the low-density oils from the general consumption; and we earnestly trust that ere long the Act will be put into such effective operation that none but oil of this class shall be sold. Is there not, however, still a very great deal of danger that explosions may occur? To this it may be replied, that under ordinary circumstances it is not so. But under certain conditions, and they are not at all infrequent, explosions can and will occur, be the Petroleum Act never so vigorously enforced.

If our readers are at all familiar with the petroleum lamps of cheaper construction,—those for example to be found so commonly in the houses of the poor,—they will have noticed how rude and imperfect these are, both in principle and manufacture. Three points present themselves for notice in the construction of these lamps which especially deserve attention, since they are related to circumstances calculated to give rise to explosion. In the first place, the burner of the lamp is so arranged that it has a direct metallic communication with the basin or bowl containing the oil; in the second, the aperture through which air is admitted to supply the place of the liquid consumed, is unnecessarily large and close to the flame; and thirdly, the tube in which the wick is placed is generally so much larger than the wick that a wire of considerable size might directly be thrust down from the flame to the petroleum beneath. These may appear trivial peculiarities, but they are in our opinion just the opposite, and are the sources of many accidents, which were they rectified, need not occur, even with oil of very low flashing-point. Owing to the high temperature produced during combustion in most petroleum lamps, the brass work becomes heated some hundred degrees, so that, indeed, it is quite impossible to touch it. This heat is communicated to the bowl, and from this to the petroleum, which then volatilizes rapidly. The next step —in cases where inferior oil is used—is that the vapour, in passing up through the vacant space in the wick-tube or through the air-hole, becomes ignited at the flame, and that thus, like the powder in the touch-hole of a gun, the mixture of air and vapour in the bowl becomes ignited, and, expanding with violence, bursts the bowl into atoms, and scatters the burning, and inextinguishably burning liquid, over everything in the neighbourhood, carrying destruction with it nearly wherever it goes.

Now our legislators say this is all avoided by using the oil prescribed by the statute. "Such oil is never heated to a hundred degrees, and therefore never gives off inflammable vapours." To this we reply, firstly, that in inferior lamps, burnt for many hours, and with the flame, as generally is the case, at a great height, it is quite possible to have the oil raised to a hundred degrees; and hence that the statute does *not* protect us. But seeing that the statute is practically inoperative, and that cheap oils will always find a market, and that there is no reason why even cheap oils should not, if possible, be utilized, we think that something should be done in a direction different to that taken by the Legislature; we mean in the direction of the lamp itself.

What is there to prevent our constructing a lamp in which the present legal oil, and even inferior kinds, may be burnt with perfect safety? We ourselves see nothing. There are three provisions to be made. Firstly, we should separate the burner from the basin by a ring composed of some very bad conductor of heat; secondly, we should provide that the "wick" should fit the tube exactly, and that some fixed and permanent wick, such as those made of asbestos or fine wire, should be employed; and lastly, we should adopt the well-known principle of the Davy lamp in the case of the air-hole (always covering this, whatever its size, with a piece of fine wire-gauze). In a lamp so constructed we should not fear to burn the worst oil now in commerce. It would be perfectly safe, while existing forms of lamps are not; and we trust, therefore, that our makers will take the hint and do that which Government ought to have done, but which, of course, it did not. "How not to do it" might have been very well in the days of the *State*, but in these days of the *Nation*, the phrase should be allowed to become obsolete.

THE WEEK.

PROFESSOR HUXLEY has been applying ethnology to politics. In his speech at the meeting on Monday last, in connection with the proposed Workmen's International Exhibition, Mr. Huxley endeavoured to disabuse our Legislature of the idea that in dealing with the Irish they have a Celtic race to deal with which it is impossible to conciliate. Mr. Huxley—with questionable justification—asserts that the Irish people are not more Celtic than the English, and, quoting Dr. Johnson, he said to the ideal legislator, "Sir, first clear your mind of all cant." We quite agree with Professor Huxley that the Irish have no ethnic peculiarities which render them less susceptible to the influences of rational legislation than their English brethren, but we dissent from his proposition as to the non-Celtic character of the Irish, which we apprehend is based on no certain facts.

HERR PROFESSOR HELMHOLTZ has been elected corresponding member of the French Academy of Sciences. The vacancy was in the section of physics, and was caused by the death of M. Marianini. Herr Helmholtz obtained the great majority of votes.

THE American Institute does not seem to be behind our own Royal Institution in its efforts to popularize science. The following are some of its lectures for the current month:—Friday, Jan. 7th, The Air and Respiration, by Professor J. C. Draper, of the College of the City of New York. Friday, Jan. 14th, The Connection of Natural Science and Mental Philosophy, by Professor J. Bascom, of Williams College, Williamstown, Mass. Friday, Jan. 21st, The Constitution of

the Sun, by Dr. B. A. Gould, of Cambridge, Mass. Friday, Jan. 28th, The Colorado Plateau, its Cañons and Ruined Cities, by Professor J. S. Newbury, of Columbia College, New York.

Dr. Giuseppe Corradi, of Florence, has just received the important sum of 5,000 francs, being part of the Argenteuil prize of the Paris Academy of Medicine, for his valuable labours and writings.

Medical education and the system of medical licenses are on the eve of a great revolution, and if anything could assist the influences at work for reform, the able series of papers now publishing in our contemporary, the *Medical Mirror*, ought to do so. These papers are, we understand, written by a member of the profession, who is not only an accomplished physician but an expert writer and advanced thinker. They are entitled "The Medical Institutions of the United Kingdom: a History exemplifying the Evils of Over-legislation."

We regret to announce the death of M. E. Gueymard, Honorary Dean of the Faculty of Science at Grenoble, and a very well-known French mining engineer.

In the Faculty of Science at Rennes, M. Didon will deliver the course on pure mathematics in the place of M. Peslin.

According to a contemporary, the *Photographic News*, M. Petersen, of Copenhagen, has purchased the right to practise the Alberttype process in Denmark for 10,000 francs, although it is rumoured that another photographer in that city, M. Schroder, is working a similar process of his own invention. A M. Manecke, of Leipsic, has also a process, the secret of which he offers to sell for 100 thalers (£15).

The funds for the Faraday Memorial have reached £14,000. Let us hope that this large sum will be properly and prudently expended.

The trigonometrical survey of England and Wales, on the scale of one inch to a mile, has been completed during the past week. It was commenced in the year 1791.

There is reason to believe that we may next year see an amalgamation of all the Medical Societies of London—save one or two—into an Academy of Medicine, or—as loyalty will display itself—a Royal Society of Medicine. Why we should have so many Royal Societies we cannot imagine. The "Royalty" costs money, and is of no earthly use to the body corporate. There was a meeting on Monday evening of the delegates of the several societies seeking fusion.

The squabble between the students and authorities of Queen's College, Galway, still goes on. The President's letter in Saturday's *Lancet* is, however, tolerably satisfactory. It seems that the visitors, who are the only Board of Appeal, have declined on technical grounds to hold a visitation.

The Royal Botanic Society, of whose doings we have never been able to speak in very laudatory terms, has chosen to become jealous of the Royal Horticultural. It seems, on the showing of the *Gardeners' Chronicle*, that the Royal Botanic Society has fixed one of its great summer shows for the same day on which a meeting of the Royal Horticultural Society had long before been advertised to take place—that meeting being the South Kensington Rose Show. Such an act of uncourteousness might, thinks the *Chronicle*, have befitted the days of fierce and uncompromising rivalry, but seems utterly inexplicable in times when it has been understood that the two Societies were jogging on peacefully together. The fact remains; and the Rose Show has, in consequence, been shifted to June 29th, as announced in the advertisements.

The courses of lectures this session at the College of Surgeons will be peculiar, in that for the first time the new Professor of Dermatology, Mr. Erasmus Wilson, F.R.S., will enter upon his duties. It will be remembered that Mr. Wilson gave the College £5,000 for the endowment of a chair of Dermatology, and the College very naturally selected the donor, not because of his gift, as our contemporaries seem to imply, but because of the great value of his researches, anatomical and clinical, in relation to the skin. At the conclusion of Professor Wilson's course, Professor Flower, F.R.S., will deliver eighteen lectures on the anatomy of the mammalia; and in June next Professor Birkett, F.R.C.S., and Mr. Hulke, F.R.S., will complete the lectures for the present collegiate year, the former gentleman by a course of six lectures on the nature and treatment of new growths, and the latter by a course of three lectures on the minute anatomy of the eye, in continuation of his subject of last year.

Signori Fissore and Ignazio Nicolis, of Turin, have been nominated Professors Extraordinary to the Turin University; the former of Hygiene and Medical Pathology, and the latter of Clinical Medicine.

Mr. George Barnard seems aggrieved that Dr. Bence Jones, in the *Life and Letters of Faraday*, should have implied that Faraday received public relief when he was nine years old. Mr. Barnard writes as follows to correct this error:—The question as to whether Faraday ever received public relief may not, perhaps, interest the public very much; but as it is quite a mistake, and never occurred, his friends are anxious that it should be corrected, and I have to request of your kind courtesy the insertion of these lines. The Faradays never received any public relief, but at this time they were, no doubt, poor, and bread was very dear—I believe 1s. 9d. the quartern loaf. Old King George III. set an example to his subjects by restricting himself to one small piece of bread at dinner, and allowed no pastry or puddings to be made in the Royal kitchens; and it was recommended by the Government that every one at such a period of scarcity should make use of rice, potatoes, and other food, and so diminish the consumption of wheaten flour. I have more than once heard my brother-in-law tell the story of their domestic economy at this time. Faraday said that at the beginning of the week his mother gave him a quartern loaf for himself, that he might have the management of it entirely. He immediately marked it out carefully into 14 portions, one of which he ate each morning and evening, thus learning his first lesson in frugal economy.

It would seem that the late Consul at Massowah is in some pecuniary difficulty, and it is proposed to raise a fund in his behalf by means of subscriptions. Mr. W. Jesse, the Zoologist to the Abyssinian Expedition, urges that something should be done.

The Record Office has not much connection with Science, yet if we wished to make any inquiries into the relation of scientific men to the State in early times, it is to the Record Office we should go. It is satisfactory, then, to find that the Chancellor of the Exchequer means to have the Office open to the public at night. This we believe is only the thin end of the wedge, and it is hoped that shortly the Reading-room at the British Museum and the principal public libraries will be thrown open during the evening. This would be a great boon to those students whose more pressing engagements keep them occupied during the day.

The chemical impurities of gas have become a practical question at last. The Corporation has summoned its Gas Company, and has had it fined £50, and £14 costs. Chemists may rejoice, there is a new field for them—we mean the chemico-legal one.

As we had anticipated, the accident to the machinery at Abbey Mills was attended with the most dreadful damage to property in Blackwall; but, unhappily, it appears that the sufferers have no redress.

Mr. Palmer, an eminent Arabic scholar (travelling Fellow of the University of Cambridge), has arrived in Arabia, where he and a friend will spend some months among the Arabs of

the unknown district bordering upon Sinai. The object of Mr. Palmer is to learn and record the legends believed to be still existing there as to the passage of the Israelites and their sojourning in the neighbourhood. Mr. Palmer has undertaken this difficult task for the Palestine Exploration Society.

Owing to the recent inclement weather, little has been done in prosecuting the search for gold in the county of Inverness. The weather having become somewhat more favourable, the Messrs. Ferguson Brothers, acting on instructions from the several proprietors interested, are now conducting an examination of the entire watershed of the rivers Nairn, Farigaig, and Foyers, and the adjoining districts, with the view of determining the extent and productiveness of the auriferous area. Mr. P. G. Wilson has also employed experienced diggers to prosecute the search in the valley of the Nairn, and other promising places. In the event of gold being found in paying quantities, all the proprietors of the district seem disposed to permit the working of it on their estates. The diggers in Daviot report to Mr. Wilson that they have found traces of gold in various places, but they do not feel sanguine that the working of it will pay.

More News of Livingstone.—The Rev. Forbes Capel, the secretary of the Central African Mission, writes as follows:—"I am sure your readers will be glad to learn still later news of the great traveller than has yet been published. Bishop Tozer, writing from the Mission House, Zanzibar, under date October 25, 1869, says:—'I spoke a few days since with an Arab trader, who informed me that he had seen Dr. Livingstone four months before at Ujiji.' This brings us to July. Up to that time, therefore, he had not been eaten by the cannibals to whom he alluded in his last letter."

The storm which raged over the country on Friday night and Saturday morning appears to have been the most violent we have had for some years. Singularly enough it was not preceded by any serious or sudden decrease of atmospheric pressure. The barometer fell about half an inch, but not with any great rapidity. At Manchester it was attended with thunder and lightning. The disasters to shipping have been not only numerous but most peculiar.

The death of Mr. James Wylson, architect, is announced. Born at Glasgow in 1810, his name was first made known by having designed the plans of St. Luke's Church, and of the Prince's Theatre. As the founder of the Athenæum in Glasgow, he obtained the thanks of the inhabitants. On coming to London he was for some time working under Mr. Sydney Smirke and Sir Charles Barry, until he was appointed surveyor to the National Land Society. For some years he was the architect and surveyor to the Conservative Land Society. Mr. Wylson had great scientific attainments, and was the originator of the British Association of Architectural Draughtsmen, editor of the *Engineer's Pocket Journal*, and author of the *Mechanical Investors' Guide*.

The Rev. J. Halford, writing under date of the 7th, says that Venus is just perceptible now by daylight. He saw her with great ease and distinctiveness on the 6th at 3.35 p.m. The sun, which was shining at the time, did not set until half an hour afterwards, viz., at 4.5 p.m.

A Belgian Society of Mental Medicine has just been instituted. Two general meetings have already taken place, the former at Ghent, and the latter at Brussels. The society reckons amongst its members all the distinguished medical men of the kingdom who are interested in mental affections, and it has provided for the admission of foreign students who may be inclined to become members and furnish contributions.

The Lord Rectorship of the Aberdeen University is still undecided. It is supposed that the decision in the tie will not be given, or at least announced, till the keen feeling in the matter has subsided. It was rumoured that Sir William Stirling-Maxwell has written the Chancellor to the effect that under the rather peculiar circumstances into which the contest had fallen he would decline to be elected. The above, however, which was simply a rumour, has not been confirmed in any way; but it is believed that as matters have gone as they did Sir William would prefer giving place to Mr. Grant Duff, for whom the majority of the students voted. It is not believed that the protest lodged against Mr. Boswell will result in disqualifying that gentleman; but, as political principles are not involved, it is considered not improbable (and among the Duffites sanguinely expected) that the Duke of Richmond will, as on last occasion, give his vote for Mr. Grant Duff. In the event of the election falling on the Principal, it is all but certain to be Sir William that will be selected. Meanwhile the students are anxiously awaiting the casting vote of the Chancellor.

The Lettsomian lectures of the Medical Society of London will be delivered by Dr. Tilbury Fox, on January 10th and 24th, and February 7th, at 8.30 p.m. The subject of the lectures will be the Pathology and Treatment of Ekzema, and, incidentally, the Influence of Constitutional Conditions in Skin-Diseases.

The *British Medical Journal* countenances the somewhat startling hypothesis that the use of the sewing machine tends to prevent sterility in women.

Classes have commenced at the Working Men's College in Great Ormond-street. Physiology, astronomy, and microscopy are the chief scientific subjects taught.

Professor Symes Thompson will commence his course of lectures at the Gresham College on Friday. The subjects will be as follows:—Lecture I., Friday, January 14th, "On Catching Cold;" Lecture II., Saturday, January 15th, "On Stimulants." The lectures are illustrated with diagrams, tables, and chemical experiments; are free to the public, and commence each evening at seven o'clock. Lectures will be also delivered by the Gresham Professor of Medicine in Easter, Trinity, and Michaelmas terms.

Dr. Temple has been expressing his opinion on the relation of science and theology. In delivering the prizes to the students of the Science School at the Mechanics' Institute at Plymouth on Saturday, the new bishop was received by a large and enthusiastic audience, who rose on the entrance of Dr. Temple, and vociferously cheered him. In his address his lordship enforced the practical utility of scientific knowledge, and argued that there was perfect harmony between science and revelation. Teachers, he said, should pervade scientific teaching with a religious tone.

The statistics of New Zealand for the year 1868 have just been issued, and contain many tables and returns of interest and importance.

Professor Cope's *Synopsis of the Extinct Batrachia and Reptilia of North America*, recently issued, is a volume in every way worthy of Transatlantic science. The plates are exquisitely drawn.

A very elaborate, prolonged, and important discussion has taken place at Manchester on the subject of the Patent Laws. It took place on the occasion of a very able paper by Mr. Aston, and the whole feeling of the meeting seemed to be that protection was demanded for the inventor. We quite think with the meeting. There is a class of optimist legislators lately sprung up whose whole ideas are based upon *à priori* arguments from hypothetical doctrines.

The winter conversazione of the Working Men's College took place on the evening of the 7th, at the College House, Great Ormond-street. The anniversary derived additional interest from the fact that the new class-rooms and museum had been so far completed as to permit of their being thrown open for the inspection of the visitors. The class-rooms, six in

number, are built on the lower portion of the grounds, in the rear of the college, are well lighted, and of spacious dimensions. The conversazione was an immense success.

On this day week Professor Gamgee's new process for the preservation of meat, by means of carbonic oxide and sulphurous acid, was put to the test in the presence of a number of visitors who were much interested in the operations. By this new method the meat is kept from decomposition for some months, and in no mere physical character does it differ from ordinary uncooked meat. We understand that some of our large salesmen have already put Professor Gamgee's process in practical operation on a large scale, and with the best results. Meat preserved in this way in America has reached this country in perfectly good condition, and now it is being put to the severe test of a voyage from Australia—across the line.

Dr. T. Spencer Cobbold, F.R.S., delivered the opening lecture at the South-London Working Men's College on Monday evening last. The classes have all opened. Female students are admitted.

The *Agricultural Gazette* of Saturday contains a very able review, by the Rev. M. J. Berkeley, on an American Report on the Disease of Cattle. It is especially of interest because it treats of Hallier's views on the supposed relation between fungi and disease, and deals with the subject in a critical but impartial spirit.

An ancient Roman silver-mine has been discovered near Heidelberg. It was disclosed by the falling of some rocks owing to the recent shock of earthquake. There is not much silver in the ore, but a good deal of zinc, which the Roman workers rejected.

The following choice piece of scientific nonsense has just been sent to us by its author, Mr. J. Hampden, of Swindon:—"What is to be said of the pretended philosophy of the nineteenth century, when not one educated man in ten thousand knows the shape of the earth on which he dwells? Why, that it must be a huge sham! The undersigned is willing to deposit from £50 to £500 on reciprocal terms, and defies all the philosophers, divines, and scientific professors in the United Kingdom to prove the rotundity and revolution of the world from Scripture, from reason, or from fact. He will acknowledge that he has forfeited his deposit, if his opponent can exhibit, to the satisfaction of any intelligent referee, a convex railway, river, canal, or lake. Failing to do this by or before the 25th of February, the advertiser to claim the amount deposited, which shall be spent in exposing the falsehood and fraud of the Newtonian philosophers."

The Americans are certainly a wonderful people, who are able for all emergencies. The other day, finding that one of the large hotels—the Hotel Pelham, of Boston—projected too far into a street which they wished to widen, they determined to move the building, weighing 5,000 tons, bodily back by means of various mechanical contrivances. They made the attempt, and succeeded, without doing the smallest damage to the premises.

The French *Journal Officiel* of the 7th announces that the post of Director of the Fine Arts Department has been suppressed, and M. Weiss has been appointed Secretary-General. Count Nieuwekerke has been appointed Superintendent of the Imperial Museums.

Admiral Englefield's hydrostatic steering apparatus appears to have turned out well, as the following letter to the inventor from the Secretary to the Admiralty will prove:—"My Lords have great satisfaction in informing you that the reports of the trial of your hydrostatic steering apparatus since the alterations are satisfactory, and show that it will be a valuable instrument in the *Achilles*."

Now that the question of the sale of poisons is exciting public attention, too much stress cannot be laid on the facts disclosed in Dr. Ballard's letter to the *Times* of Monday. The writer shows that an oilman not only sold tartar emetic, in considerable quantity, for carbonate of soda, but that the jar in his shop in which the antimony was contained was actually labelled cream of tartar. Heaven knows what terrible disasters might have happened had not Dr. Ballard's activity discovered the dreadful blunder!

The *Journal of Cutaneous Medicine*, a quarterly periodical, will cease to appear. Its Editor and mainstay, Mr. Erasmus Wilson, F.R.S., announces the fact in his preface to the third volume, just completed.

THE COMPARISON OF THE CORALS OF THE ATLANTIC AND PACIFIC COASTS OF THE ISTHMUS OF DARIEN.

BY PROFESSOR A. E. VERRILL.

THE question of a former connection between the Atlantic and Pacific, across the Isthmus of Darien, has very important bearings both in zoology and geology. With many geologists it has been a favourite and convenient theory to account for climatic changes in Europe by a depression of the Isthmus sufficient to allow the Gulf Stream to flow into the Pacific. Admitting a connection, it does not necessarily follow that the Gulf Stream would flow into the Pacific, for a current in the opposite direction might result, while with a shallow channel, owing to the difference in the tides (twenty-two feet at Panama and about two at Aspinwall), it is probable that the flow would be first one way and then the other. The evidence from geology is quite insufficient to establish the theory, and the facts cited have in most cases proved unreliable. The zoological evidence is mainly the occurrence of identical and closely allied species on both sides. Thus of mollusca about 1,500 species occur upon the west tropical coast, of which Dr. P. P. Carpenter enumerates thirty-five species as identical upon the two coasts; thirty-four as doubtful, but possibly identical; and sixty-seven that are closely allied, but evidently distinct. Since his lists were published, other species have been added to them, among which *Paphrydia bullata*, a common West Indian shell, which has recently been received with *Codakia tigerina* from the Gulf of California, by the museum of Yale College. Dr. Stimpson admits eight or ten species of Crustacea as identical, and although Mr. Ordway has separated the *Callinectes* of the west coast satisfactorily, there are other identical species among the large collections recently received from that coast by the museum of Yale College, through Mr. Bradley and others, so that of about 150 species of Decapods, ten or twelve appear to be perfectly identical, not showing even varietal differences. Among 173 species of marine fishes from both coasts, Dr. Günther regards fifty-seven as identical. Mr. Gill would, however, separate some of these forms, but the general result would still remain the same, since certain species do not show even varietal differences. The Echinoderms of the two coasts have been examined and tabulated by me,[1] and gave very different results, for of eighty-two species found on the west coast none are identical with those of the Atlantic, unless two Holothurians which may be regarded as doubtful, though considered the same by Selenka. But at least fifty of the species are analogous, or correspond with similar Atlantic species.

A careful comparative study of the corals and polyps of the Atlantic, and extensive, and, for the shallow water forms, nearly complete collections from various localities on the Pacific coast, give quite unexpected results, since no species are found to be identical, while even the genera and families show remarkable contrasts. Thus the numerous genera and families of reef-

[1] *Transactions of the Connecticut Academy*, vol. i. p. 339. 1867.

building corals, so abundant on the Atlantic side, are wholly wanting on the Pacific, with the exception of Porites, which is represented by three or four small species. Massive Astræans. Mæandrina, Diploria, Manicina, Colpophyllia, Agaricia, Siderastræa, Oculina, Madrepora, Millepora, are wholly unknown in the Panama fauna. But Pocillipora, Montipora, and Pavonia, genera unknown on the Atlantic side, are represented, the last by two gigantic species. Among the Halcyonoid Polyps we find an equal contrast, for Eunicea, Plexaura, Plexaurella, Pterogorgia, and many other very common Atlantic genera are unknown on the Pacific side, where they are replaced by numerous species of Psammogorgia, Litigorgia, and Eugorgia, which are eminently characteristic of that coast.

The genus Muricea is very common, and represented by seventeen species, while on the Atlantic side only four species are usually admitted, all of which are so different as scarcely to be regarded as analogous species. The genus Renilla is found on both coasts. Among the Actinians we find greater resemblances, but as yet no identical species.

From these facts we may legitimately conclude that no very extensive or deep connection, sufficient to alter the course of oceanic currents, can have existed since the coasts have been inhabited by the existing species, otherwise a greater admixture must have taken place. A narrow or shallow channel of communication would probably account for all identical species yet observed, but at what period it may have existed is still another question. The occurrence of certain Atlantic species in the Gulf of California and not at Panama (*Codakia tigerina, Paphrydia bullata*); the evidence of a uniform and long continued flow of the Gulf Stream, to be derived from the growth of the extensive coral reefs of the Bermudas, and the southern extension of Florida with its numerous ancient reefs of coral rock, one of which occurs even as far north as Tampa Bay, made up of existing species, show that the present coral faunæ are of immense antiquity, and also that the specific characters are wonderfully persistent. The peculiar relations between the two faunæ manifested by the numerous analogous but distinct species and genera, are probably facts of a different order, and will require a different solution; for even if we adopt a developmental theory we shall doubtless be compelled to refer the period of separation to a period far more ancient than that at which the few identical species became separated, and to admit a far more extensive and prolonged connection between the two oceans.—*Paper read before the American Association.*

ON THE FERTILIZATION OF GRASSES.

BY DR. R. SPRUCE.

IN gently flowing rivers of tropical America, grow many fine aquatic grasses, species of Luziola, Oryza, Leersi, &c. The following note is from my journal under date December, 1849, when threading in my canoe among the islands of the Trombetas:—"This channel was lined on both sides by a beautiful grass—a species of Luziola—growing in deep water, and standing out of it 2 ft. or 3 ft. The large male flowers, of the most delicate pink, streaked with deep purple, and with six long yellow stamens hanging out of them, were disposed in a lax terminal panicle; while the slender green female flowers grew on the bristle-like branches of much smaller panicles springing from the inflated sheaths of the leaves that clothed the stem. As the Indians disturbed the grassy fringe with the movement of their paddles, the pollen fell from the anthers in showers," and would, doubtless, some of it, attain the female flowers disposed for its reception.

A parallel case to the above is that of the common Maize (*Zea Mays*, L.), where the male flowers are borne in a long terminal raceme or panicle, and the female flowers are densely packed on spikes springing from the leaf-axils. Here the male flowers must plainly expand before the pollen contained in their anthers can be shed on the female organs below, whether of the same or of a different plant. That there are frequent cross-marriages in Maize is evidenced by the numerous varieties in cultivation in countries where it is a staple article of food, as in the Andes of Ecuador, where nine kinds, varying in the colour of the grain (through white, yellow, and brown, to black), in its size, consistence, and flavour, are commonly cultivated; besides many others less generally known.

In *Pharus scaber* (H. B. K.) another tall broad-leaved grass, the spikelets stand by twos on the spike—a sessile female spikelet, and a stalked male spikelet.

In the fine forest grasses of the genus Olyra, whereof some species, such as *O. micrantha* (H. B. K.), rise to 10 ft. high, and have lanceolate leaves above 3 in. broad, and a large terminal panicle, with capillary branches, like those of our *Aira cæspitosa*, it is the lower flowers that are male, with large innate (not versatile) anthers, and the upper that are female, with two large stigmas, that are either dichotomously divided, or clad with branched hairs, thus exposing a wider surface to the access of the pollen. And as the panicle is often pendulous, many of the male flowers, although placed lower down the axis, are actually suspended over the terminal female flowers.

It is generally to be remarked of diclinous Grasses, that either the male flowers are very numerous, as in *Zea Mays*, or the stamens are multiplied in each male flower, as in Pariana, Leersia, Guadua, &c.; or the stigmatic apparatus of the female flowers is enlarged, so as almost to insure impregnation, as in Olyra and Tripsacum.

In the Bambuseæ I have gathered belonging to the genera Guadua, Merostachys, and Chusquea, the flowers are more or less polygamous, and the stamens of the male flowers often doubled. But there is scarcely a genus in the whole order which is not described as having some flowers by abortion, neuter or male, and especially those that have biflorous spikelets, such as the Paniceæ. Some grasses, of normally hermaphrodite genera, are not unfrequently truly unisexual, such as certain species of Andropogon. I have occosionally seen panicles of *Orthocladus rariflorus* (Nees), a grass peculiar to the Amazon, quite destitute of stamens, and therefore purely female.

To come home to our own country: Is all the pollen wasted that a touch or a breath sets free from the flowers of grasses in such abundance? Watch a field of wheat in bloom, the heads swayed by the wind, lovingly kissing each other, and doubtless stealing and giving pollen. Consider, too, that throughout Nature, heat or moisture, or both, are essential to the emanation of the impregnating influence. In all our Festuceæ, as well as in Cynodon, Leersia, and some other genera, the stigmas are protruded from the side or from the base of the flower at an early stage, often before the stamens of the same flower are mature—thus as it were inviting cross fertilization from the more precocious stamens of other plants which are already shedding their pollen.

All who have gathered grasses will have remarked that some have yellow anthers, others pink or violet anthers; and that anthers of both types of colour may co-exist on distinct individuals of the same species. The same peculiarity is just as noticeable in tropical grasses, and (without professing to give a complete physiological explanation of it) this is what I have observed respecting it. The walls of the anther-cells are usually of some shade of purple, but are so very thin and pellucid, that when distended with mature pollen the yellow colour of the latter is alone visible. When the pollen is discharged, the anthers resume their original purple colour, shortly, however, to take on the pallor or dinginess of decay. Where the anthers emerge of a purple hue, and change from that to brown, it will probably be found that they have discharged their pollen while still included in the flower. These observations, made without any reference to the question now

in hand, require to be renewed and tested; and in them, as in all that precedes, I am open to correction.

Of grasses with bisexual flowers, there are two ways in which the ovary may be fertilized, viz., either by the pollen of its own flower (closed or open), or by that of other flowers, after the manner of the diclinous species. In the latter case, the pollen may be transported by the wind, or in the fur of animals (as I have observed the seeds of Selaginellas in South America), or in the plumage of birds. The agency of insects has not been traced in the fertilization of grasses, but may exist. The little flies I have seen on the flowers of grasses seemed bent on depositing their eggs in the nascent ovaries, but may also have aided in cross-fertilization. In the Amazon Valley grasses are often infested by ants, who, indeed, leave nothing organic unvisited throughout that vast region; and they also, I think, cannot help occasionally transferring grains of pollen from one flower to another.

The flowers of Palms and Grasses agree in being usually small and obscurely-coloured, but contrast greatly in the former being in many cases exquisitely and strongly scented, whereas in the latter they are usually quite scentless. The odour of Palm-flowers often resembles that of Mignonette; but I think a whole acre of that "darling" weed would not emit more perfume than a single plant of the Fan Palm of the Rio Negro (*Mauritia Carará*, Wallace). In approaching one of these plants through the thick forest, the sense of hearing would perhaps give the first notice of its proximity, from the merry hum of winged insects which its scented flowers had drawn together, to feast on the honey, and to transport the pollen of the male to the female plants; for it is chiefly dicœcious species of Palms that have such sweet flowers. The absence of odoriferous flowers from the Grasses seems to show that insect aid is not needed for effecting their fecundation, but does not render its accidental concurrence a whit less unlikely.

That Grasses, notwithstanding their almost mathematical characters, vary much as other plants do, is plain from the multitude of osculating forms (in such genera as Eragrostis, Panicum, and Paspalum), which puzzle the botanist to decide when to combine and when to separate, in order to obtain what are called "good species." Hence the conclusion is unavoidable that in grasses, as in other plants, variations of surrounding conditions induce corresponding modifications of structure, and that amongst the former must be enumerated cross marriages, however brought about.

If the flowers of grasses be sometimes fertilized in the bud, it is probably exceptional, like the similar cases recorded of Orchids and many other families.

To conclude: the more I ponder over existing evidence, the more I feel convinced that in its perfect state every being has the sexes practically separated, and that natural selection is ever tending to make this separation more complete and permanent; so that the hypothesis of Plato, that the prototype even of man was hermaphrodite, may one day be proved to be a fact!—*A Paper read before the Horticultural Society.*

PHOTOGRAPHY ON CANVAS.

WE were recently favoured by Mr. Lothian, of Edinburgh, with a sight of some admirable examples of the mode of printing introduced some months ago by Mr. Davies, by which almost any surface, no matter how unsuitable for photographic purposes, gave fine pictures after treating with a sizing preparation consisting of a mixed solution of shellac and gelatine. It was suggested at the time that such a process appeared to be pre-eminently well suited for printing on canvas, and Mr. Davies and others promised to put the matter to the test of experiment. This has been done, and Mr. Lothian, who is well versed in canvas printing, has worked in conjunction with Mr. Davies for this especial branch, and with such satisfactory results that he has resolved to use none other.

For printing on canvas the chief modification of the formula consists in diluting the sizing solution considerably. The surface of the canvas, primed for printing, being non-absorbent, a much thinner coating of the lac and gelatine solution is desirable, as a thick film might cause some eventual tendency to exfoliation. The formula as originally given by Mr. Davies is as follows:—

Take from four to six grains of gelatine, soak it in an ounce of water for an hour, then melt it gently over a fire, hot-plate, or water-bath, using a clean earthen pipkin. When fully dissolved, add to it, while yet warm, and stirring it gently during the mixing, from four to six drachms of a solution of white lac in methylated spirit, if for white or pale surfaces; but orange lac will do if the surface be of a darker colour. This is made in the proportion of 6 oz. of spirit to 1 oz. of lac, and digesting it till fully dissolved. The mixture of the gelatine and gum lac in spirits produces a creamy-looking emulsion, to which is added four grains of chloride of sodium, or a like equivalent of chloride of ammonium or barium, and, when fully dissolved, filter through fine muslin into a clean pipkin, and it is ready for use.

This is, we believe, the formula still employed for paper with success, and we may remark, in passing, that for paper, a fifty-grain ammonia-nitrate solution gives a rich, velvety quality of picture, which is, in our estimation, much superior to that obtained with the plain silver solution. When the ammonia-nitrate is used, a fine, rich, purple brown tone is obtained by fixing in hyposulphite of soda, one part in eight of water, without toning.

In applying the process to canvas printing, the lac and gelatine solution is to be diluted with an equal bulk of water, or, we should presume, better still—in order to avoid the risk of precipitating any portion—with equal parts of alcohol and water. If the preparation be made for use with canvas, of course it will be made of the proper strength at once; but if the mixed solution have been prepared for paper, it must be warmed, and the proper proportion of alcohol and water added, a little at a time, stirring briskly. The preparation thus diluted remains fluid, and requires but slightly warming for use.

Previous to applying it to the painter's canvas, the prepared surface of the latter is sponged with a little methylated spirit, to remove dirt or grease, and prevent any tendency to repel the sizing solution. When the surface is dry, the lac and gelatine solution is applied smoothly with a sponge. The surface dries in a few minutes. The silver solution is applied with a tuft of cotton wool. We may observe here that ammonia-nitrate of silver is on no account to be used in exciting the canvas, as the alkali, rapidly acting on the priming of the canvas, would penetrate and dissolve it. The silvered surface being dry, the canvas is placed under a negative and exposed, the printing being more rapidly effected than with albumenized paper. When sufficiently deeply printed, the canvas is turned up at the edges, and secured at the corners by spring clips, so as to form a dish. Into the dish so formed the hyposulphite fixing solution is poured, and suffered to remain about ten minutes.

Mr. Lothian states that by observation he had arrived at a criterion of perfect fixation. When the surface is so thoroughly permeated by the fixing solution that it felt slightly soft and yielding when pressed by the finger, instead of being perfectly hard and rigid, experience has proved that the image is perfectly fixed.

When the image is fixed, one corner of the canvas is released from the clips; and, after pouring away the hypo., the surface is washed for a quarter of an hour by means of a flexible tube attached to the water-pipe, care being taken at no stage of the proceedings to wet the back of the canvas. No toning is necessary, as the image, when fixed only, is of a rich, warm, purple brown tint, well suited to the purposes of the oil painter.

It will be seen that in this form of canvas photography printing direct from the negative is contemplated; where enlarging is necessary an enlarged negative is used, and a direct print produced therefrom. There is little doubt, however, that by the use of iodides and bromides the surface prepared with the same sizing solution might be made sufficiently sensitive for solar camera printing by development.—*Photographic News.*

EXPERIMENTS ON THE ELECTRICITY OF PLANTS.

BY EDWIN SMITH, M.A.

THERE is a very interesting chapter in Becquerel's smaller treatise (in three volumes) on *Electricity and Magnetism* concerning the electrical phenomena of plants. I was induced, by reading this chapter, to make a series of experiments, with a view to illustrate the author's statements, and, if possible, to throw some fresh light upon an obscure and puzzling subject. I am now going to put together some notes of these experiments, carefully made at the time, in the hope that they may not be without a certain interest to others. The galvanometer employed is a home-made one, but tolerably sensitive. My greatest difficulty has been to depolarize the slips of platinum by means of which I have made the voltaic circuits; but every care has been taken, to the best of my ability, to obviate error arising from this cause, as well as from thermo-electric disturbance.

Experiment 1.—Take the thick, juicy leaf-stalk of the common garden rhubarb, and, having cut off a length of from 4 in. to 18 in., apply a square of platinum foil to each end of the piece. Connect, by means of platinum wire, these two plates with opposite terminals of the galvanometer. The needle will be powerfully deflected. Now reverse the position of the rhubarb between its platinum surfaces, connect as before, and the needle will again be deflected, but in an opposite direction. Having previously ascertained how to interpret the movements of the needle, by noticing its behaviour when a voltaic current is produced between zinc and diluted acid, with platinum for negative plate, and transmitted through the coil, you will at once conclude that a current of electricity is passing from that end of the leaf-stalk nearest the root towards the oppcsite end, nearest the blade of the leaf.

Experiment 2.—Cut off a piece about 3 in. long from the thickest part of the same leaf-stalk. Divide it longitudinally down the middle. Pare off a level slice of the outer cuticle. Lay the platinum slips close to the two flat sides thus provided, and connect with the galvanometer. There will be indicated a current from the outer side nearest the cuticle to the inner axis of the leaf-stalk. If the section is made thinner, there will be a current in the same direction. You may confirm your conclusion, as before, by simply turning over the piece of rhubarb, so as to reverse the current. Experiments one and two may be tried upon a thick midrib or branch of the same, taken from the leaf-blade, with a precisely similar result. A cucumber acts in the same way.

Experiment 3.—Insert a platinum wire into the lower end of the flower-stalk of peony. Apply foil to one of the large bracts, or to a petal; connect, and observe deflection. A current is detected flowing from the lower end of the flower-stalk to the bract or petal. The same experiment may be tried with a sprig of fresh oak-leaves, or bramble, or chickweed, or bunch of elder-buds, or poppy-flower, or stalks and leaves of poppy. The current always sets from the point nearest to the root towards the organs furthest from the root. If wires be inserted in the pistil of a flower and its stalk, there will be shown a current flowing towards the former.

Experiment 4.—Lay a leaf of the common dock between pieces of platinum foil. Connect the different surfaces with opposite terminals of the galvanometer, and notice the deflection. A current is indicated from the upper to the under surface of the leaf. A leaf of Spanish chestnut or of young elder will give the same result; but, in four experiments on a leaf of sycamore, I got a current from the under to the upper surface, after a momentary current in an opposite direction. I infer, however, that the momentary current was the true one, and that the second arose from polarization; for I obtained this latter current by merely employing filter-paper dipped in distilled water, and laid between the slips of foil.

Experiment 5.—Twist a piece of wire round the outer cuticle of a young twig of hawthorn. Insert a second wire between the bark and wood, so as to touch the layer of cambium. On completing the circuit, a current will be indicated from the cambium to the outer cuticle. Again: pass a wire into the pith, and a current may be detected taking a direction from the cambium to the pith. Instead of hawthorn, a cutting from a fresh branch of elder, laurel, hedge-mustard, thistle, groundsel, yarrow, or other dicotyledonous plant, may be employed, with, as I have uniformly found, the same effect.

Experiment 6.—Scrape off the outer cuticle of the root of cress. By means of wires, as before, test the direction of the electric currents. They will be found to flow from the outside to the axis of the root, and, again, from the root-stock, or point of junction with the stem, towards the lower tapering end. The same effects are exhibited by the root of cat's-ear, or of thistle. If plates of platinum foil are applied to the flat surfaces made by cutting across the thick and thin ends of a carrot, a current will be found to set from the thick end of this root to the smaller end.

Experiment 7.—Take a bunch of the seeds of sycamore. Dip a samara attached to the stalk near its broader end into one of the mercury-cups, and a samara attached to the stalk at a point nearer the smaller end into the other cup. A current is indicated from the former towards the latter, in strict analogy to what happened in the third experiment. Or a piece of the stalk itself may be bent, and its ends dipped into the mercury-cups. A current will be indicated, having the same direction as before. A cutting from any pliable stem may be tried in this way, and always, so far as my experience goes, with a similar result.

Experiment 8.—Pass a platinum wire through the tubular hollow of a stem of Poa, or some other meadow-grass. Twist another platinum wire round the outside, and connect both with the galvanometer. A current will be shown, having a direction from the interior to the exterior surface of the stem in question. Such appears to be the law with the stems of monocotyledonous plants.

Experiment 9.—Make two cuts through a raw potato, one through the centre, another near the outer coat. Apply strips of platinum to the two flat surfaces, and connect with opposite terminals of the galvanometer. A current is shown to be passing from the centre towards the outside. A lemon, treated in the same way, furnished a current from the outside towards the centre. With a turnip, a gooseberry, and a pear, the same result was obtained; but a stalk of asparagus followed the law of the potato. A boiled potato, tested, when cold, by the same method, gave a current from the outside towards the centre, the indication being confirmed by a reversal of the slice between the platinum conductors. But, after moistening a fresh piece of boiled potato with distilled water, a current was obtained from the centre towards the outside—a result confirmed by reversing the position of the slice between the platinum conductors, as in the previous trial. Fresh platinum was employed, to obviate, as far as possible, any error from polarization.

Experiment 10.—Reduce to a pulp with distilled water some of the meal nearest the coat of a baked potato. Then make a similar pulp of some of the meal at the centre. Having placed a plug of tow at the bend of a U-tube, pour the pulps thus prepared into different limbs. Connect, by slips of wire and platinum, with the galvanometer. In my experiment, a current was indicated from the outer pulp towards the inner pulp,

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agreeably to the result of my first experiment with a slice of boiled potato. My object was to destroy all vitality in the tuber by boiling or baking, and to see whether any chemical action might still remain—sufficient to cause a voltaic current when meal from different parts of the potato was made to furnish a voltaic couple.

Experiment 11.—Having procured a garden nasturtium growing in a flower-pot, insert a wire in the fleshy stem, a few inches above the soil. Then thrust a second wire through the small hole at the bottom of the pot into the soil. Connect with galvanometer. The needle is so deflected as to indicate the passing of a current from the plant to the soil in which it grows. Watering the soil made no change in the direction of the current when I performed the experiment. I also stuck the first wire into the stem in various ways and in various parts, always with the same results. At the same time, a current was detected passing from the root end towards the leaf end of the stem, conformably to the rule in other cases.

Experiment 12.—Make a solution of oxygen in distilled water, also a solution of carbonic acid. Pour them into the different limbs of a U-tube furnished with a plug of tow. Insert platinum slips, and connect with galvanometer. There will be a marked deflection of the needle, showing the passage of an electric current from the oxygen to the carbonic acid. Confirm the result by reversing the platinum connectors.

The foregoing series of experiments are enough to set one thinking; but I feel that it would be premature to reason upon them at present, even with the admirable clue afforded by the treatise of M. Becquerel. I should like to compare, for instance, the electrical phenomena of plants in spring and in autumn, to see how far they are affected by the condition and flow of the sap. In a future paper, I may, perhaps, be permitted to return to the subject, and attempt some *rationale* of the curious order of facts above described.—*Chemical News.*

VOLCANOES AND EARTHQUAKES.

BY T. STERRY HUNT, LL.D., F.R.S.

IN TWO PARTS.—PART I.

IT is proposed in the present lecture to discuss the nature and causes of volcanoes and earthquakes, with their related phenomena, and to consider the reason of their peculiar geographical distribution. Violent movements of the earth's crust are confined to certain regions of the globe, which are at the same time characterized by volcanic activity; from which it is reasonably inferred that the phenomena of earthquakes and volcanoes have a common origin. The discharge through openings in the earth's crust of ignited stony matter, generally in a fused condition, and the disengagement of various gases and vapours, accompanied by movements of elevation or subsidence of considerable areas of the earth's surface, sometimes rapid and paroxysmal and attended with great vibratory movements, are evidences of a yielding crust of solid rock resting upon an igneous and fluid mass below. To the same conditions are also to be ascribed the slow movements of portions of the earth's surface shown in the rise and fall of continents in regions remote from centres of volcanic activity. The unequal tension of the yielding crust and the sudden giving way of the overstrained portions are probably the immediate cause of earthquake phenomena; the seat of these, according to the deductions of Mallet, is to be found at depths of from seven to thirty miles from the surface.

A brief description of the phenomena of volcanoes will be necessary as a preliminary to the inquiry which constitutes the object of our lecture. Volcanoes are openings in the earth's crust through which are discharged solid, liquid, and gaseous matter, generally in an intensely heated condition. Sometimes the ejected material is solid, and consists of broken comminuted rock, or the so-called volcanic ashes. Oftener, however, it is discharged in a more or less completely fused condition, constituting lava, which is sometimes fluid and glassy, but more frequently pasty and viscid, so that it flows slowly and with difficulty. The ejected materials, whether liquid or solid, build up volcanic cones by successive layers—a fact which has been established by modern observers in opposition to the notion come down from antiquity, that volcanic hills are produced by an uprising or tumefaction of previously horizontal layers of rock by the action of a force from beneath. First among the gaseous products of volcanoes is watery vapour; water appears not only to be involved in all volcanic eruptions, but to be intimately combined with the lavas, to which, as Scrope has shown, it helps to give liquidity. The water at this high temperature is retained in combination under great pressure; but as this pressure is removed passes into the state of vapour, a process which explains the swelling up of lavas and their rise in the craters of the volcanoes. Besides watery vapour, carbonic and hydrochloric acid gases, and hydrogen, both free and combined with sulphur and with carbon, are products of volcanoes. The combustion of the inflammable gases in contact with air sometimes gives rise to true burning mountains—a name which does not properly belong to such as give out only acid gases, steam, and incandescent rocky matters, which are incombustible. The escape of elastic fluids from lavas gives to them a cellular structure, but when slowly cooled under pressure, as seen in the dykes traversing the flanks of volcanoes, the stony materials assume a more solid and crystalline condition, and resemble the older eruptive rocks found in regions not now volcanic. These include granites, trachytes, dolerites, basalts, &c., and are masses of rock which, though extravasated after the manner of lavas, became consolidated in the midst of surrounding rocks, and consequently under considerable pressure. Their presence marks either the lower portions of volcanoes whose cones have been removed by denudation, or outbursts of liquefied rock which never reached the surface. The escape of such matters, and the formation of volcanic vents, are but accidents in the history of the igneous action going on beneath the earth's surface. We shall, therefore, regard the extravasation of igneous matter, whether as lava or ashes at the surface, or as plutonic rock in the midst of strata, as, in its wider sense, a manifestation of vulcanicity, and for the elucidation of our subject consider both these regions characterized by great outbursts of plutonic rock in former geologic periods, and those now the seats of volcanic activity, which, in these cases, can generally be traced back some distance into the tertiary epoch. To begin with the latter, the first and most important is the great continental region which may be described as including the Mediterranean and Aralo-Caspian basins, extending from the Iberian peninsula eastward to the Thian-Chan Mountains of Central Asia. In this great belt, extending over about 90° of longitude, are included all the historic volcanoes of the ancient world, to which we must add the extinct volcanoes of Murcia, Catalonia, Auvergne, the Vivarais, the Eifel, Hungary, &c., some of which have probably been active during the human period.

It is a most significant fact that this region is nearly coextensive with that occupied for ages by the great civilizing races of the world, From the plateau of central Asia, throughout their westward migration to the pillars of Hercules, the Indo-European nations were familiar with the volcano and the earthquake; and that the Semitic race were not strangers to the same phenomena, the whole poetic imagery of the Hebrew Scriptures bears ample evidence. In the language of their writers, the mountains are molten, they quake and fall down at the presence of the Deity, when the melting fire burneth. The fury of his wrath is poured forth like fire; he toucheth the hills and they smoke, while fire and sulphur come down to destroy the doomed cities of the plain, whose foundation is a molten flood. Not less does the poetry and the mythology of Greece and of Rome bear the impress of the nether realm of fire in

which the volcano and the earthquake have their seat, and their influence is conspicuous throughout the imaginative literature and the religious systems of the Indo-European nations, whose contact with these terrible manifestations of unseen forces beyond their foresight or control, could not fail to act strongly on their moral and intellectual development, which would have doubtless presented very different phases had the early home of these races been the Australian or the eastern side of the American continent, where volcanoes are unknown, and the earthquake is scarcely felt.[1]

Besides the great region just indicated, must be mentioned that of our own Pacific slope, from Fuegia to Aliaska, from whence along the eastern shore of Asia, a line of volcanic activity extends to the terrible burning mountains of the Indian archipelago. Volcanic islands are widely scattered over the Pacific basin, and volcanoes burn amidst the thick-ribbed ice of the Antarctic continent. The Atlantic area is in like manner marked by volcanic islands from Jan Mayen and Iceland to the Canaries, the Azores, and the Caribbean islands, and southward to Ascension, St. Helena, and Tristan d'Acunha.

The continents, with the exception of the two areas already defined, present no evidences of modern volcanic action, and the regions of ancient volcanic activity, as shown by the presence of great outbursts of eruptive rocks, are not less limited and circumscribed. In northern Europe, the chain of the Urals, an area in central Germany, and one in the British islands are apparent, and in North America there appear to have been but two volcanic regions in the paleozoic period—one in the basin of Lake Superior, and another, which may be described as occurring along either side of the Apallachian chain to the north-east, including the valleys of the lower St. Lawrence, Lake Champlain, the Hudson and Connecticut rivers, and extending still farther southward. The study of the various eruptive rocks of this region shows that volcanic activity in different parts of it was prolonged from the beginning of the paleozoic period till after its close.

Having thus before us the principal facts in the history of volcanoes, we may proceed to notice the various theories from time to time put forward to account for them. The first and most obvious notion is that of combustion, and we find early writers supposing that volcanoes might be due to the burning of coal, bitumen, or sulphur. As juster ideas were acquired of the nature of combustion, and the necessity of a supply of air for its maintenance, other chemical agencies were invoked as the probable source of internal fire. Lemery suggested the oxidation of sulphurets in the presence of water; and the brilliant discovery by Davy, in the earths and alkalies, of metallic bases which decompose water with great violence, and even with the phenomena of combustion, gave rise to the so-called chemical theory of volcanoes, which has found its defenders down to our own time. This theory supposes that the interior of the globe consists of the metallic bases of earths and alkalies, which are oxidized by the gradual access of the ocean's water, with the production of intense heat, causing the fusion of the resulting oxides, which constitute lavas and eruptive rocks. The chemical objections which may be urged against this theory are numerous, and to my mind insuperable; in addition to which it may be added that it fails to explain the facts connected with the past and present distribution of volcanoes, and is in disaccord with those views of the early condition of the globe most in harmony with the deductions of modern astronomy, physics, and chemistry.

[1] Compare the fine lines of Pope, in the "Essay on Man," where, of superstition, the poet says:—

> "She, 'mid the lightning's glare, the thunder's sound,
> While rocked the earthquake, and while rolled the ground—
> She taught the proud to bend, the weak to pray,
> To Powers unseen and mightier far than they;
> She, 'mid the rending earth and bursting skies,
> Saw gods descend and fiends infernal rise;
> Here fixed the baleful, there the blest abodes—
> Fear made her devils, and weak hope her gods."

I need not here repeat the arguments in favour of the theory which supposes our earth to be a cooling globe, which has passed through various stages, from an uncondensed nebulous mass to a liquid, and finally to its present solid condition, with a cold exterior; nor to the evidences of a regularly increasing temperature as we descend into its crust, from which it is concluded that at a depth of a few miles a heat of ignition would be attained. If we suppose that the solidification of the once liquid globe to have begun at the surface, which became thus covered with a feebly conducting crust, it would not be difficult to admit, as some imagine, a still liquid centre, surrounded by a shell of congealed matter upon which are spread the sedimentary strata. Various and independent arguments from the phenomena of precession, from the theory of the tides, and from the crushing weight of mountain masses like the Himalayan, have, however, been brought against this hypothesis of a thin crust resting upon a liquid centre, and in addition to these another important one of a different order. Judging from the known properties of the rocks with which we are acquainted, solidification should commence not at the surface but at the centre of the liquid globe, a process which would moreover be favoured by the influence of pressure. This augments the melting temperature of matters which, like the rocks and most other solids, become less dense when melted, while on the other hand it reduces the melting point of those which, like ice, become more dense by fusion. Pressure, moreover, it may be mentioned in this connection, increases the solvent power of water for most bodies, whose solution may be described as a kind of melting down with water into a compound whose density is greater than that of the mean of its constituents; the importance of this point will appear farther on. The theory deduced from the above considerations, and adopted by Hopkins and by Scrope, is briefly as follows:—the earth's centre is solid, though still retaining nearly the high temperature at which it became solid. At an advanced stage in the solidifying process the remaining envelope of fused matter became viscid, so that the descent from the surface of the heavier particles, cooled by radiation was prevented, and a crust formed, through which cooling has since gone on very slowly. There were thus left between this crust and the solid nucleus, portions of yet unsolidified matter (or even perhaps, as suggested by Scrope, a continuous sheet), and it is in the existence of this stratum, or of lakes of uncongealed matter, that we are to find an explanation of all the phenomena of volcanoes and earthquakes, of elevation and subsidence, and of the movements which result in the formation of mountain chains, as ingeniously set forth by Mr. Shaler. The slow contraction of the gradually cooling globe, a most important agency in the latter phenomena, is evidently not excluded by this hypothesis. It may be added that a similar structure of the globe, viz., a solid nucleus and a solid crust, separated from each other by a liquid stratum, was long ago suggested by Halley in order to explain the phenomena of terrestrial magnetism. Scrope has completed this hypothesis by the suggestion that variations in tension or pressure may cause portions of matter beneath the surface to pass from solid to liquid, or from a liquid to a solid state, and in this way help us to explain the local and the temporary nature of volcanic activity.—*Lecture recently delivered.*

ON THE DIFFERENT METHODS OF MEASURING MICROSCOPICAL OBJECTS.

MEMOIR BY COUNT A. F. CASTRACANE D' ANTELMINELLI.

IN TWO PARTS.—PART II.

TAKE, for example, for observation a Diatom in the shape of a boat, in which the central nodule is seen to be dilated transversely, and I recognize it as a *Stauroneis Phœnicenteron* (Ehrbg.). The valves of this diatom are ornamented with very fine moniliform striæ,

and rows of granules. I wish to know their thickness or the number of them which correspond to a millimètre. For that purpose: 1st, I adapt to the microscope a micrometer eyepiece; 2nd, I cause the division to be superimposed on the lines of the Stauroneis, exactly combining one of them with one of the divisions; 3rd, I count the striæ comprised between five divisions of the micrometer, and find they are exactly eight. I ought now to ascertain the value of a unit in the division of the eyepiece, and I obtain it by substituting for the preparation placed under the microscope an objective micrometer, that is to say, a millimètre divided into a hundred parts, and cut on a thin glass; and recognizing that in the magnifying power used forty-nine divisions of the eyepiece corresponded to six hundredths of a millimètre, I establish the proportion : 49 : $0{\cdot}66^{mm}$: : 1 : x. Thence $x = \frac{0.66^{mm}}{49} = 0{\cdot}001224^{mm}$, which is the value of a unit in our case. Now, since eight was the number of the striæ which were counted in five units of the ocular micrometer, we ought to say: if in $5 \times 0{\cdot}001224^{mm}$ there are eight striæ, how many are there in one millimètre? And the final result will be $\frac{8}{0{\cdot}006120^{mm}} = 1307$. Whence the striæ of the *Stauroneis Phœnicenteron* are of such fineness that 1,307 of them are contained in a millimètre.

Although such a method of taking small measures may be correct in theory, and in most cases is found the most practical, yet in many circumstances of recognizing the finest details it becomes a difficult and uncertain method. And this is specially the case when one has to do with the most difficult Diatomaceæ, the study of which requires the most powerful objectives, and the most accurate direction of the illumination. Any one who has familiarized himself with the study of these can well bear me witness how the perception of very fine striæ requires a sustained tension of the visual faculty, so that one frequently hesitates, and it is not always possible to recognize without hesitation and with certainty the number of very minute striæ which may be confined in an interval which, relatively to the magnifying power used, and to the infinite smallness of the details, appears considerable. Such an inconvenience I have been able partly to obviate by the use of variable eyepiece micrometers. I have two of these, one with cobweb lines, constructed by Nachet, of Paris, the other with variable points by Hartnack; the two lines or threads of the first and the two points of the second are separated from each other to a given distance, which is determined in the first place by comparison with an objective micrometer. The Diatom being placed in the middle of the field of vision under the variable micrometer, the number of striæ is determined, either at one glance or by very slowly advancing one of the lines or one of the points, and fixing all the attention on the point or line in motion, and on the crossing made successively by the striæ, from which it is possible to determine the number.

But still, this method presents a grave difficulty in the oscillation which is inevitably communicated to the instruments, so that more striæ seem to pass before or behind the movable point: so that here again I find myself in uncertainty and in the fear of erring. Such difficulties cannot be overcome otherwise than by rendering the eyepiece micrometer independent of the body of the microscope, by fitting to it a supporting foot distinct from the mounting in question. In the absence of such an arrangement. when I am about to occupy myself with the Diatomaceæ, which are most difficult, on account of the extreme delicacy of the striation with which they are adorned, I usually approach the two points of Hartnack's micrometer very close, so as to be able to include in the interval only one or two striæ which I judge I can easily keep within view. Afterwards I substitute for the microscopic preparation, in the plane of the object-holder, the objective micrometer, with the micrometer cut on the glass, with the camera lucida; I draw the interval between the two points, and that of a hundredth of a millimètre magnified in the microscope, and by observing the number of times that the latter is greater than the former, and multiplying it by the number of striæ observed between the two points, I obtain the number of striæ contained in one hundredth of a millimètre, and consequently the number contained in a millimètre.

All these systems certainly give an approximate idea of the measures, but we cannot expect from them an exact and precise determination, and this so much the more in proportion as the basis of the calculation may be smaller,—seeing that any error there may be in the first place, though only of a fraction of a stria by being multiplied as many times as the smallest space is comprised in the measure of the millimètre magnified in the microscope, may amount to a sufficiently notable difference from the truth. And this I think may be the origin of the differences in the number of the striæ which are observed in the Diatomaceæ of the most distinguished micrographers, who purposely and specially, or only accidentally, have occupied themselves with the Diatomaceæ, in order to the determination of the species to which they belong. Having, however, proposed to occupy myself principally with the study of this interesting class of organisms, I was led to think of some method which, by facilitating the operation, would lead me to a more exact estimation, rendering it not only possible, but relatively easy, to count the striæ, and in consequence determine their sizes and that of their intervals.

Such a method I find in the habitual use of photo-micrography, by which means I reproduce the different forms which present themselves in my researches. Having proposed to myself to edit a most complete photographic monograph of the whole order of the Diatomaceæ, in which I have up to the present time included nearly a thousand types, I adopted the magnifying power of 535 diameters for the reproduction of these, so that I could keep an approximate account of the relation of size between one type and another. The images which I obtain directly, and which are usually called by photographers, negatives, from which I print off so many identical proofs, are obtained on plates of glass. These present with the greatest fineness and fidelity, not only the form of the Diatomaceæ, but even the finest details, which can only be perceived with doubt and great trouble when observing them directly under the microscope. Would that we could obtain equally fine results in the positive which is printed on paper, and which, by the imperfection of the surface presenting small asperities of elevated and depressed points, does not perfectly and equally adhere to the glass of the negative, and is far from presenting the same degree of fineness! Having thus at my disposition the most faithful and authentic representation of the Diatomaceæ on a plate of glass, I direct my attention to this, and on it I follow the enumeration of the striæ. To facilitate the enumeration I count the lines which correspond to a hundredth of a millimètre, multiplied five hundred and thirty-five times, and I see how many lines are included in a space of the negative equal to $5{\cdot}35^{mm}$. This measure, cut on a thin metallic plate and placed on the negative or matrix, gives the greatest facility for obtaining the number which, multiplied by a hundred, will give as the final result, the precise number of striæ, or rows of dots, which cover the valves of the Diatomaceæ.

Those, however, who are not able to have recourse to photo-micrography, which also offers the incalculable advantage of giving, as it were, an authentic reproduction of the objects under study, in order to be as near as possible to the truth, ought to have recourse to repeated measurements according to different methods, assuming for the final result, the mean number obtained by the repeated operations.—*Paper read before the Quekett Club, Nov. 26th.*

Meteoric Iron Fallen on the Collina di Brianza (Milanese Territory).—The *Chemical News* states that Dr. Hausofer has made a careful analysis of a piece of this very large meteorite, about the origin of which some doubt has existed. The specific gravity of this material is 7·596; it does not contain sulphur or chromium, and was found to consist, in 100 parts—of iron, 91·1; nickel, 7·7; phosphorus, 0·3; cobalt, 0·2; and traces of carbon.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From December 26th, 1869, to January 8th, 1870.

Date.	Name.	Country.	How obtained.	Where placed in Gardens.
1869.				
Dec. 30	1 Common Badger (Meles taxus) ♂	British Islands.....	Deposited by Sir V. A. Brooke, Bart, F.Z.S.	Small Mammal House
1870.				
Jan. 3	1 Bonnet Monkey (Macacus radiatus) ♂	Continental India...	Presented by R. S. Kirby, Esq.	Monkey-house
4	1 Pig-tailed Monkey (Macacus nemestrinus) ♂	Java	Presented by Lieut. Codrington Hall, R.N.	Ditto
	1 Guinea Baboon (Cynocephalus papio) ♂	West Africa.....	Presented by Mr. Hart	Ditto
5	1 Stump-tailed Lizard (Trachydosaurus rugosus)	New Holland	Presented by Dr. E. L. Mosse, R.N. ...	Reptile-house
6	1 Temminck's Tragopan (Ceriornis Temminckii)	China	Deposited by R. Swinhoe, Esq., F.Z.S.	Pheasantry
	1 Great Northern Diver (Colymbus glacialis)	British Islands.....	Presented by A. E. Hunt, Esq.....	Fish-house
	Collection of Fish Ova	.....	Presented by F. T. Buckland, Esq., F.Z.S.	Ditto
8	1 American Bison (Bison Americanus) ♂	North America.....	Deposited by W. C. Herring, Esq., F.Z.S.	Cattle Sheds
	1 Javan Chevrotain (Tragulus Javanicus) ♂	Java	Presented by H. H. Gideon, Esq.	Anteater's-house

♂ Male.

THE HARMONY OF COLOUR AND MUSIC.

BY W. F. BARRETT, F.C.S.

IT is in this division of our subject that we find a widespread and tacit acceptance of the analogy of light and sound. We instinctively criticise in like terms the works of a painter and a musician. We speak of the harmonious blending of colours in a picture, as we do of the chords in a musical composition. We compare, apparently without reason, the order of colours in a rainbow to the notes of the gamut. Like Locke's blind man who said scarlet was to him as the deep sound of a trumpet, we think of red as a low note, of blue as a high one. We find, as a rule, that good taste in art goes hand-in-hand with good taste in music; hence a large number of eminent painters have been excellent musicians.[1] All this points to the fact that pleasure given to the eye or ear evokes similar mental impressions.

Now the question arises, Has all this æsthetic oneness of colour and music any physical foundation, over and above that general analogy we have so far traced between light and sound? We believe the following considerations will show not only that it has some foundation, but that the analogy is far more wonderful than has hitherto been suspected.

Let us take as our standard of colours the series given by the disintegration of white light, the so-called *spectrum*. As our standard of musical notes let us take the natural or *diatonic scale*. We may justly compare the two: for the former embraces all possible gradations of simple colours, and the latter a similar gradation of notes of varying pitch.

Further, the succession of colours in the spectrum is perfectly harmonious to the eye. Their invariable order is red, orange, yellow, green, blue, indigo, violet. Any other arrangement of these colours is less enjoyable. Likewise the succession of notes in the scale is the most agreeable that can be found. The order is C, D, E, F, G, A, B.[2] Any attempt to ascend or descend the entire scale by another order is disagreeable. The order of colours given in the spectrum is exactly the order of luminous wave-lengths, decreasing from red to violet. The order of notes in the scale is also exactly the order of sonorous wave-lengths, decreasing from C to B.

The interval of wave-lengths embraced between the extreme colours of the visible spectrum is ordinarily as the ratio of 1 : 0·57, corresponding to the interval known as a seventh in music. But the writer is well informed that, by proper means, further limits can be seen—viz., from what is known as the solar line A to the solar line L.[3] The wave-length of A is 76, and of L is 38 hundred-thousandths of a millimètre, or as the ratio of 1 : 0·50, corresponding to the interval of an octave in music, or just the range of the scale.

Arbitrarily placing C under the colour of the solar line A, viz., a deep brownish red, then the octave higher of C would fall under whatever colour is found at the solar line L—viz., a lavender grey. Now comes this important question—Are the intermediate colours of the spectrum produced by vibrations that bear a definite ratio to the vibrations giving rise to the intermediate notes of the scale? According to our knowledge up to this time, apparently not.

In an ingenious little work by Dr. Macdonald, before alluded to, an attempt has been made to establish this analogy indirectly;[4] but if direct comparison fails, it is useless to push the matter farther. Newton himself sought for this analogy between note and colours, but he only found the relative spaces occupied by each colour in the spectrum to be similar to the relative intervals of musical notes. This is, obviously, a false analogy. We must compare wave-lengths of light with wave-lengths of sound; not, of course, their actual lengths, but the *ratio* of one to the other.

Until very recently it has been impossible to do this accurately. New maps of wave-lengths of the different parts of the spectrum have, however, of late appeared.[5] Let us reduce the newest and best determinations of wave-lengths to a common ratio, and compare the result with the wave-lengths of the notes of the scale reduced to the same ratio. Here are the limits of wave-lengths of the different colours of the spectrum as most carefully determined by Prof. Listing.[6] In the third column the writer has added the mean wave-length of each colour, and in the fourth column the ratio of one colour to another, taking the mean wave-length of red as 100.

TABLE OF WAVE-LENGTHS OF COLOURS IN THE SPECTRUM.

WAVE-LENGTHS: IN MILLIONTHS OF A MILLIMÈTRE.

Name.	Limit.	Mean.	Ratio.
Red	723 to 647	685	100
Orange	647 to 586	616	89
Yellow	586 to 535	560	81
Green	535 to 492	513	75
Blue	492 to 455	473	69
Indigo	455 to 424	439	64
Violet	424 to 397	410	60

[1] Omitting many living painters of whom this is true, it is sufficient to name Tintoretto, Caracci, Salvator Rosa, Domenichino, Guido Reni, Leonardo da Vinci; and Rubens also is said to have been passionately fond of music.

[2] The fact that Newton saw seven colours in the spectrum, and there are seven notes in the scale, is only an accident; the number of colours, or tints, entirely depends on the judgment of the observer.

[3] This is on the authority of Mr. Crookes, who has on favourable occasions seen the spectrum extending this length, where a quartz train of lenses and prisms was employed.

[4] It is a pity this brochure of Dr. Macdonald's is so disfigured by its typography. It is also too speculative and dogmatic.

[5] The most recent by Thalen. *Transactions of Royal Society of Upsala*, 3rd Series, vol. vi.; also *Annales de Chimie et de Physique*, Oct. 1869.

[6] Poggendorff's *Annalen*, vol. cxxxi. p. 564.

Here next is a table giving the middle notes of the scale, their wave-lengths and their reduction to a common ratio, taking C as 100.

TABLE OF WAVE-LENGTHS OF NOTES OF SCALE.

Name.	Wave-length in inches.	Ratio.
C	52	100
D	46⅓	89
E	42	80
F	39	75
G	35	67
A	31	60
B	27½	53
C_2	26	50

Putting together the two ratios, the following remarkable correspondence at once comes out:—

RATIO OF WAVE-LENGTHS OF NOTES COMPARED TO RATIO OF WAVE-LENGTHS OF COLOURS.

Notes.	Ratio.	Colours.	Ratio.
C	100	Red	100
D	89	Orange	89
E	80	Yellow	81
F	75	Green	75
G	67	Blue and indigo (mean)	67
A	60	Violet	60
B	53	[Ultra violet	53]
C	50	[Obscure	50]

Assuming the note C to correspond with the colour red, then we find D exactly corresponds to orange, E to yellow, and F to green. Blue and indigo, being difficult to localize, or even distinguish in the spectrum, they are put together: their mean exactly corresponds to the note G. Violet would then exactly correspond to the ratio given by the note A. The colours having now ceased, the ideal position of B and the upper C in the spectrum are calculated from the musical ratios. This coincidence, as unexpected as it is perfect, is represented in the two upper figures on the plate.

Had space permitted, we should have ventured to trace out to some extent this common harmony of colour and sound. All we can do is to point out a few suggestions that occur at once.

Every one knows that the juxtaposition of two colours nearly alike is bad, and it is well known that two adjacent notes of the scale sounded together produce discord. Selecting and sounding together two different notes we may produce either discord or harmony; so with the juxtaposition of certain colours, either pleasurable or painful effects are produced. Thus —the notes D and E, together, are bad; so are orange and yellow when contrasted. C and G harmonize perfectly, so do red and blue. C and F is an excellent interval, so is the combination of red and green. Now on referring to the plate, it will be seen that the foregoing notes exactly underlie those very colours that we have named with them.

But, further, it is possible to obtain a real optical expression of the musical intervals.[7] By reflecting a beam of light from one vibrating tuning fork to another placed at right angles, curves of light are obtained, which vary according to the combination of forks we select. The most perfect harmony, viz., two notes in unison, gives the simplest curve—a circle. The next most hamonious interval, an octave and its fundamental note, gives the figure of 8; the next, the interval of a fifth, gives a more complete figure, and so on, the complexity augmenting as the concord lessens.

A musical chord thus becomes both a representative picture and an acoustic painting, whilst the musical scale is literally a rainbow of sound. It is hardly too much to say that we might possibly translate into a musical melody a sunset, a flower, or a painting by a Rubens or a Raphael.[8]

But here let us check our imagination. We have throughout the foregoing article endeavoured to avoid overstating the analogy. Let us now be careful lest we become victims of the "*idola tribus*," lest we strive to impose on Nature a greater degree of simplicity than her facts will justify.—*Quarterly Journal of Science.*

[7] First accomplished by M. Lissajous.

[8] On this subject an able article, by Mr. C. Seth Smith, recently appeared in the *Builder*.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

THE RELATION BETWEEN THE PHYSICAL FORCES AND THE PHENOMENA OF VITALITY.

BY C. STANILAND WAKE, F.A.S.L.

IN TWO PARTS.—PART II.

THE key to the difficulty as to the relation between the physical and the vital forces is to be found in the existence of the organism. Given this, *plus* the physical forces (if their divorce can be supposed), and, under ordinary conditions, the phenomena of vitality are the result; while, if the organic character be subtracted from the matter of the organism, the physical forces are found to be present. Thus stated, it is evident that the vital force and the physical forces differ only in the presence or absence of the organism as such. If it were not so, it would be difficult to understand what is meant by the loss of vitality, or the death of organized matter. If the vital force is neither a phase of the physical forces, nor capable of being resolved into them, it must be absolutely annihilated at death—a result which may well lead Professor Helmholtz to say that the hypothesis of a vital force is "in direct opposition to the law of conservation of force." As we cannot conceive any force to be really lost or annihilated, and as the vital force can only continue to exist after the destruction of the matter which it vitalized, as physical force, it must always have been only a special phase of the latter, and capable at any time of being resolved into it. Nevertheless, as we have seen, the *organism* can never be produced by the mere action of the physical forces, although it cannot be doubted that the action of these forces is essential to the *maintenance* of vitality. According to Mr. Grove's view, indeed, life is the result of the *combined* action of the physical forces. But, as Dr. Beale truly remarks, "We may have any and all modes of force without life. Life, therefore, involves something besides force, and is something different from it."[1] This *something* is, nevertheless, merely the organism itself, the operation of which reduces all the physical forces into that special force to which its vitality is due.

It has been shown that at death vital force is resolved into physical force. This is required by the doctrine of the Conservation of Force. The same process is, however, continually going on in the body of the living organism, as is well shown by the change which *germinal matter* undergoes in becoming *formed material*. It is evident that this result, as described by Dr. Beale, cannot be reached without an accompanying change of force. The inanimate pabulum, whose elements, when it has arrived at the living centre, are converted into the germinal matter, has, in the very process, had its forces converted into the vital force. On the other hand, when germinal matter loses its special character, and as material becomes gradually formed, the vital force is resolved again into the forces which were exhibited by the pabulum from which the germinal matter was elaborated; or at least into forces as nearly like them as the difference between the inorganic form of the pabulum and the organized formed material will allow. Owing to this difference, the forces into which the vital force is thus resolved are not exactly the same as those of inorganic matter. Formed material not only undergoes "various physical and chemical changes under the influence of heat, moisture, oxygen," &c., but it possesses certain remarkable properties due to "the

[1] *Protoplasm*, p. 9.

changes which had been brought about while this matter existed in the antecedent or living state."[2] Such are the *irritability* and *contractility* which are characteristic of nervous and muscular tissue, and which must, therefore, be merely the result of the action of the ordinary physical forces on the formed material of the organism. These properties may probably be regarded as intermediate conditions, which, as they have originated in the action of the vital force, so they themselves give rise during their action to the physical forces proper. It may be that in this action we have a chief source of the heat generated so plentifully in the animal body.

According to this view, *irritability* and *contractility* would seem to be differentiations of the *vital force*, these properties themselves becoming resolved into heat and the other physical forces. It should not be lost sight of, however, that force is merely a property of matter—*essential*, no doubt, but still a property which, if matter could be annihilated, would also be destroyed—and therefore the formed material which exhibits irritability and contractility may be said to be specializations of the living matter itself. Hence, there can hardly be the absolute difference between *germinal matter* and *formed material* which Dr. Beale supposes. It is inconsistent to say that "matter may be more or less perfectly or imperfectly formed," and yet that "the transition from one state into the other is sudden and abrupt."[3] If matter is imperfectly formed, it must be in an intermediate state between the germinal and the formed condition. Until it actually becomes *formed* matter it cannot be said to be really dead, and unless it is dead it must be living, and therefore *germinal*, although in a transitional and merely semi-vital state. It is in this state, doubtless, that *contractility* and *irritability* show themselves as the differentiations of the germinal force, whose phenomena are the vital ones of growth, spontaneous movement, and formation.

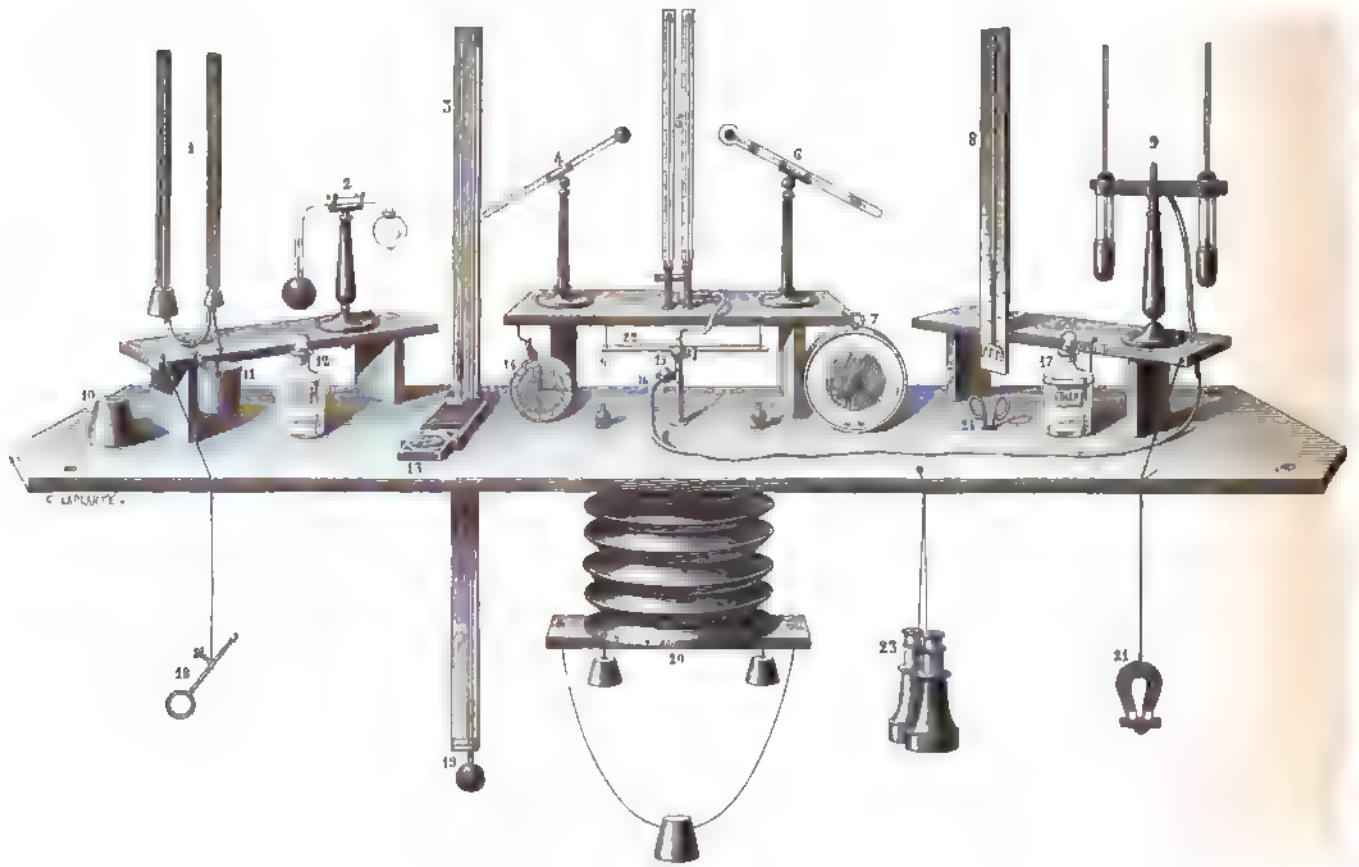
It is necessary to remember that the phenomena of growth, spontaneous movement, and formation belong essentially to the organic body *as a whole*, whereas contractility and irritability are the properties of special tissues. It is very probable, therefore, that the simple organisms which display only the first-named phenomena possess some property which may be referred to every portion of their substance, and one, moreover, which has a certain relation to those properties of the formed material to which the germinal matter has given rise. Such a property we have in that *general sensibility*, or power of reception of external impressions, which would appear to be absolutely essential to the exhibition of the special phenomena of vitality. It is, in fact, this *general sensibility* which is afterwards specialized, so as to give rise to the phenomena of the several sense organs, acting by means of the irritability of the nervous system. The way is thus prepared for a yet higher generalization. The higher animals and man himself, notwithstanding the complex vital phenomena they present, possess, as organisms, the same functions of growth, spontaneous movement, and formation as the primitive germinal matter exhibits. These are still the functions of the organism as a whole, the special tissues and organs of the body having their special properties and functions. The most important of these organs is the seat of *thought*, and the question arises whether mental action is a mode of force.

It must not be forgotten, even in relation to thought itself, that forces are simply the energy of matter, and that they can differ only in the same ratio as the forms of matter to which they belong differ among themselves. When several forms of matter *do* thus differ, the forces acting in them must also show a difference of phenomena, and it is on this ground that there is no difficulty in believing that the vital force of the organic germinal matter may be merely a synthesis of the physical forces of inorganic matter, or that these forces arise from a resolution of the vital force. When, therefore, the simple germinal matter takes on itself a more *complex* form, that of the animal organism, let us say, there must be a relative change in the phenomena exhibited by the activity of its special phase of vitality. There is the same growth, spontaneous movement, and formation of the organism as a whole; but there is also necessarily a differentiation of the property of general sensibility which is at the root of all germinal action. This differentiation is dependent on the development of the nervous system, and as sensibility itself depends for its exercise on the excitement of external media, the more specialized become the means of receiving impressions from such media, the more differentiated must the phenomena of sensibility themselves become. Hence, we find that as the organs of special sense are developed, so is the activity of the principle of sensibility increased, and its phenomenal results in external action multiplied. But *pari passu* with the development of the organs of special sense, there is a concentration of the organs which receive the impressions resulting from the action of external forces. These organs, the nervous ganglions, lose their force by isolation, and gain vastly in power when concentrated. This shows itself in the gradual evolution of intelligence out of instinct, which takes place as the nervous ganglions are thus brought together, and the organs of special sense developed. When the ganglions are concentrated, as in the brain, instinct gives place to thought, the phenomenal development of which proceeds in equal ratio with the increase in the size or complexity in structure of the brain. The value of the organs of special sense in relation to thought is seen in the *directive* influence they exert over the action resulting from it. These organs act as so many avenues through which external media force themselves into contact with the internal sensibility concentrated in the ganglions of the brain, and they guide the thinking organ in the action resulting from such contact. These conclusions appear to be legitimate inferences from the position already established of the possession by the simple germinal matter of the property of *general sensibility*. This properly is *general* in its action, because it has no special organs through which it can be influenced, and by which it can guide its activity; and it is *weak*, because it has no special nervous centres in which its power can be concentrated. Given these further developments of structure, however, and the general sensibility becomes specialized, and finally differentiated into thought. That this explanation is correct is evident from the fact that the resulting action is in all cases the same, whether the organism be that of the simple germinal Amœba or that of the anthropoid ape. The phenomena exhibited by these organisms are those of *growth*, *spontaneous movement*, and *formation*, which we have seen to be characteristic of simple germinal matter, and to these may be referred all the actions of animal life, except those connected with reproduction, which, however, can be explained by application of the principles already established. The only conclusion we can arrive at is, therefore, that, as *general sensibility* is the simple phase of the vital force exhibited by germinal matter, so *thought* is the differentiated form of the same force actively operating in and through the specialized form of such matter exhibited by the brain.

The question as to the origin of the *organic form*, which is absolutely essential to the exhibition of these various phenomena, is yet unanswered. Intimately connected with this subject is the relation between the simple thought, which is displayed by many members of the animal kingdom, and the higher mental phenomena distinctive of man, and the origin of man's superior intellectuality. The discussion of these matters would, however, occupy too much space, and it must be reserved for a future occasion.

[2] *Protoplasm*, p. 83. [3] *Ibid.*, p. 34.

Bursting of a Shooting Star.—M. Silbermann, according to the *Student*, observed a bolide, about as big as Jupiter, traverse the Great Bear on 11th Nov. at 10h. 55m. (in Paris). Part of its course was straight, and part sinuous. It swelled out to three times the size of Venus, noticeably diminished its velocity, and threw out sparks in all directions. At first this bolide was bluish white: after the partial explosion, it was not bigger, and scarcely so bright as Mars, and its velocity was more than tripled.



Mr. Glaisher's Meteorological Instruments as Arranged on the Table of his Balloon Car.

INSTRUMENTS FOR METEOROLOGICAL OBSERVATIONS DURING BALLOON ASCENTS.

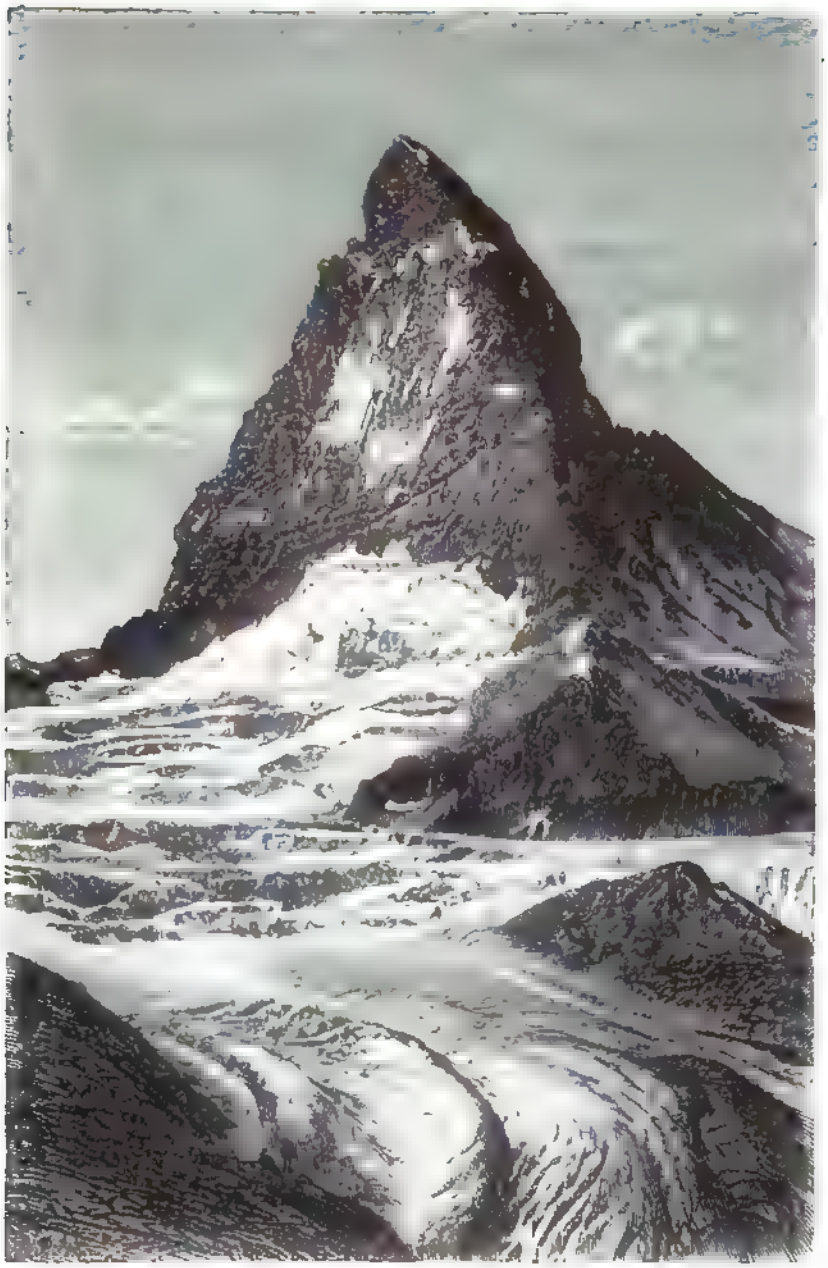
IN the splendid volume—*Voyages Aériens*—which we recently noticed, Mr. Glaisher gives a detailed account of the instruments employed by him during his balloon ascents, and describes how he arranges them on a special table, as figured above. As it may be useful to some of our meteorological readers to be acquainted with the plan adopted by Mr. Glaisher, we give the following explanation of the illustration, borrowed from M. Hachette's handsome volume. At the extreme left (fig. 1), are seen the wet and dry bulb thermometer united. The cone of the wet-bulb (fig. 10) has been lifted aside to show how the bulb is moistened through the ascent of the water by capillary attraction. Fig. 2 is Daniell's hygrometer; 3 is the mercurial barometer; 4 is the solar thermometer, with blackened bulb; 5 shows a pair of thermometers, dry and wet, connected with an aspirator, seen beneath; 6 is a black-bulb thermometer, in a glass tube and *in vacuo*, and exposed to the sun's rays; 7 is a small aneroid barometer; 8 is an exceedingly delicate thermometer, with a gridiron-shaped bulb—this bulb is employed to increase the sensibility of the instrument; 9 is Regnault's hygrometer; 10 is the cone of the bulb of the wet thermometer; 11 is the vessel of water for the same instrument; 12 is a small bottle of water for reserve; 13 is a small magnetic compass; 14 is a chronometer; 15 and 16 are two stopcocks connected with the aspirator; 17 is a bottle of ether to be used for Regnault's hygrometer; 18, a hand-lens for reading the different instruments; 19, the lower part of the mercurial barometer, provided with a counterpoise to keep it vertical; 20, aspirator, or bellows, placed so that it can be worked with the foot; 21, a magnet and armature; 22, thermometric-index (?); 23, a field-glass.

All the instruments, says Mr. Glaisher, are fastened to the table with bits of cord, and not screws, so that they may be cut and removed at a moment's notice. The table itself is supported by a strong rope, and it is made fast, when the voyagers are about to descend, to prevent it swinging about and doing mischief. As soon as it is determined to descend, Mr. Glaisher commences cutting the cords of the instruments, and throwing the latter pell-mell into a basket filled with tow, so that they are seldom injured, save when the shock of landing is very severe indeed.

THE MATTERHORN.

THE SCENE OF THE TERRIBLE ACCIDENT TO ENGLISH TOURISTS IN 1865.

ANOTHER mountain, with a toothed or dentelated peak, is Mont Cervin, which overlooks both the French and the Italian slopes of the great Alpine range. This [see page 43], the Matterhorn of the Germans and the Monte Silvio of the Italians, forms the dominant mass of the Pennine chain about forty miles E.N.E. of Mont Blanc, and between the Valais of Switzerland and the Val d'Aosta in Piedmont. Above an unbroken line of steel-blue glaciers 11,000 ft. high, it rears an almost inaccessible



THE MATTERHORN, IN THE PENNINE ALPS.

obelisk of rock to a total elevation of 14,836 ft. forming one of the grandest memorials ever raised by Omnipotence to its own honour.

In 1865 the conquest of this virgin summit was attempted by four English tourists, but their enterprise terminated in a melancholy catastrophe. It was on the 15th of July that Lord Douglas, Messrs. Hadow, Hudson, and Whymper, accompanied by three guides, undertook this perilous adventure. They succeeded in gaining the summit, and after remaining there some time they began the descent, each person being fastened to the other by a long rope. On arriving at a peculiarly dangerous portion of the journey Mr. Hadow lost his footing. He fell, and in his fall dragged down his companions. The guide who came last, with his pole, had just time to fasten the end of the rope round a projecting crag. Unhappily the weight of the four persons in advance caused the rope to break between the third and fourth of the party. Mr. Whymper alone was saved. Our three countrymen, and one of the guides who led the way, were precipitated from rock to rock from a height of upwards of 3,000 feet.—*Earth and Sea*,[1] by Louis Figuier.

[1] The editor of the work has reproduced the whole of the narrative as it appeared in the *Times*, and we commend it to Alpine tourists who have not already seen it.—*Ed. S. O.*

REVIEWS OF BOOKS.

The Anatomy and Physiology of the Blow-fly (*Musca vomitoria*, Linn.). *A Monograph.* By BENJAMIN T. LOWNE, M.R.C.S. London: Van Voorst. 1870.

A FEW years ago Mr. James Samuelson published a little book entitled *The Earth-worm and the House-fly*, in which he gave an outline sketch of these two—shall we call them domestic animals? But the work was very popular, and while it gave such an account as might be gathered from the leading English text-books on comparative anatomy, it contained no original observations, and was in all respects a purely popular treatise. In the admirable monograph before us Mr. B. T. Lowne, who is *par excellence* our English authority on the anatomy of the genus of two-winged insects, to which he has devoted his attention, has provided us with one of the most complete scientific histories which have ever been issued on any one animal, if we except the well-known instances of the Privet-moth and the Cockchafer, with which the names of Lyonnet and Straus-Durckheim are immortally associated. To an outsider, who knew little of what the industry and patience of the zootomist are, a work like this must be a perfect puzzle; and, indeed, it must appear as if a great deal of the matter, like the German's camel, was evolved out of the moral consciousness of the author. But to the biologist, who knows how much has been already achieved and how much still remains to be known, this work of Mr. Lowne's will be prized as a treatise which is not only the fullest and most comprehensive on its little subject, but as one which, when Mr. Lowne has passed away from us, will be, for the zoologist, a classic volume.

It must not be gathered from our remarks that the book before us is one which cannot be read as pleasantly by the amateur as by the working naturalist. In order to provide against this, Mr. Lowne has written an introductory description of the general anatomy of Insecta, and thus those unfamiliar with the structure of the typical insect will find much to inform them. To give even an abstract of what the author has done in dealing with the anatomy of the Blow-fly would be impossible, since he goes through the various systems of organs categorically, and under each section gives us his own original researches, an analysis of the views of foreign workers, and a beautifully engraved, and sometimes coloured, copperplate, delineating the different structures, according to specimens in his own possession.

Our readers will be, perhaps, most familiar with the proboscis of the blow-fly, as it is a very common microscopic test-object for low powers; we commend them, therefore, to the part of Mr. Lowne's work where this is described. They will find that it is not the simple apparatus they before imagined, and further, they will learn the use and construction of several parts of the proboscis which, to the eyes of mere "mounters" appear as useless. The coloured plate of this organ is a wonderful piece of anatomical drawing. The following hints on the method of preparing the proboscis for the microscope will be read with interest:—"There is no better method of examining the proboscis, in order to attain a general idea of its structure and functions, than by observing that of a living fly whilst in action. This may be conveniently done by inclosing the insect in a live-box with a very few spots of syrup on the thin glass-cover, and illuminating it from above. This method was first suggested by the late Richard Beck. Another very good way of examining the entire organ is to take a recently killed fly, exsert the proboscis by pressing on the thorax, and tie its base, to keep it extended. It may then be examined dry, or mounted in glycerine, in which it becomes a very beautiful object, when it has soaked in that medium a sufficient time to become transparent, especially if illuminated by a black-spot lens, as recommended by Mr. Suffolk. This method is subject to the grave objection that specimens so prepared are unnaturally tumid, and assume an appearance quite unlike that natural to the organ. Sections of the proboscis made with a lancet, or the entire organ cut off and mounted in glycerine, are the most instructive specimens, and are the only means of making out the minute anatomy of the part. Those required to show the distribution of nerves should first be hardened in spirit or chromic acid. Numerous recent specimens should be examined, as well as mounted specimens. Mr. Topping's well-known and beautiful preparation only exhibits the chitinous parts, and the mentum is cut away in order that the lobes may lie flat: although most useful as a means of examining the structure of the false tracheal canals and the teeth, the relations of the parts are so altered by pressure that some cannot be made out at all. All the hard parts may be seen *in situ* by treating the whole head with the extended proboscis in the manner already recommended for examining the integument of the head; but it is very difficult to mount a perfect specimen, as the lobes of the proboscis usually collapse." The part of Mr. Lowne's work which is the most valuable is that which relates to development. The observations are quite original; and though they do not complete the subject, are most valuable, and will, we trust, soon be supplemented by further investigations on the part of the author.

Faraday as a Discoverer. By JOHN TYNDALL. New Edition. London: Longmans. 1870.

A FITTING pendant—or rather should we not say Preface?—to the noble work on Faraday's Life and Letters is this biography by Professor Tyndall. In the two volumes which we recently noticed, Dr. Bence Jones has given us the history of Faraday's relations to society and the domestic circle. In the work now before us, Dr. Tyndall traces the scientific career of the great physicist; shows us how one of his grand discoveries led to another; in fact, gives us the evolution-sketch of the philosophic operations of Faraday's mind. In the work edited by Dr. Jones, Faraday, for the most part, tells his own tale. In the work of Dr. Tyndall we have a memoir by a master-hand, in outline to be sure, but in those broad, bold outlines which the old painters traced in their cartoons, leaving us a picture which, though a sketch, is yet more precious than many pictures and far above most. As this is a new edition, it is hardly necessary for us to do more than refer to its publication, and to point out that it contains a correction regarding Faraday's and Wollaston's relation to the discovery of magnetic rotation. Wollaston's idea was to make the wire carrying a current rotate round its own axis—an idea afterwards realized by the celebrated Ampère. Faraday's discovery was to make the wire carrying the current revolve round the pole of a magnet, and the reverse.

The Connection between Chemical Constitution and Physiological Action. Part II. By Dr. A. CRUM BROWN and Dr. THOMAS R. FRASER. Edinburgh: Neil & Co. 1869.

THIS is the second part of Drs. Brown and Fraser's remarkable researches on the relation between the chemical composition of certain substances and their effect on the animal body, and it deals with the physiological action of the ammonium bases derived from atropia and conia. The results of the numerous experiments described by the authors are most remarkable. They show that the substitution compounds of the alkaloids, like those of strychnia, possess qualities of their own exclusively, and differ materially from the original alkaloids. Further, they prove in regard to conia, that preparations from different sources had very different strengths—an unusual thing with alkaloids.

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No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

On the Geology of North-eastern America.—*From* Prof. Sterry Hunt.

Sir,—In your journal of Nov. 3 (p. 482), are reprinted some remarks of mine on the Geology of North-eastern America, which are but a reporter's notes of an unwritten communication made by me at the meeting of the American Association for the Advancement of Science at Salem, Massachusetts, in August last, on the occasion of exhibiting a large geological map of North-eastern America, recently published by the Geological Survey of Canada, under the direction of Sir William Logan. My observations there reported with regard to granites were made with reference to a paper read a little while previous on the geology of New Brunswick and Maine, by Messrs. Bailey and Matthew, and I said with regard to the so-called granites of a certain area that they were undoubtedly indigenous rocks, *i.e.*, granitoid gneisses of sedimentary origin, while at the same time I carefully excepted other granites of the vicinity, which are as clearly unstratified eruptive rocks. My remarks on the crystalline felspathic strata overlying fossiliferous Devonian beds in New Brunswick had reference to the same paper, and were predicted upon the supposed identification of certain organic forms there referred to. Subsequent observations, however, make it probable that these fossiliferous beds are of Upper Silurian age instead of being the equivalents of the Devonian (Dadoxylon) sandstone. Save this little correction the facts remain essentially the same.

My chief object in writing is, however, to call attention to the statement then made and given in your published note that I was led, on lithological grounds, to regard the gneisses, near Newburyport and Lowell, in Massachusetts, as of Laurentian age. These gneisses, often granitoid and syenitic in character, inclose numerous beds of crystalline limestone, accompanied by serpentine, hornblende, scapolite, apatite, spinell, &c. My suggestion has led to a search in the limestones for *Eozoön Canadense*, and Mr. Bicknell, of Salem, in the *American Naturalist* for November, has announced the discovery of this characteristic fossil in the serpentic limestone of Newburyport.[1] More recently, the crystalline limestone, holding serpentine and hornblende, at Chelmsford, near Lowell, has yielded me an abundance of *Eozoön Canadense*. Specimens of this, which have been examined and verified by Dr. Dawson, have, like that from Madoc, Ontario, the canals and tubuli of the calcareous skeleton filled, not with a silicate, but with carbonate of lime. The Eozoön in the limestones from Chelmsford as yet examined, is fragmentary, but its structure is beautifully preserved.

Hitherto the Laurentian system has not been recognized in the United States to the east of the valleys of the Hudson and Lake Champlain, but the presence of a considerable area of these ancient rocks in North-eastern Massachusetts is now rendered probable. The existence at Marblehead, on the coast near Boston, of boulders of the typical norite or labradorite rock, which is believed to characterize the Upper Laurentian or Labrador series, probably points to the existence of an outcrop of these rocks in the vicinity.

Montreal, Dec. 4, 1869. T. Sterry Hunt.

Underground Temperature at Two Feet.—*From* C. J. R.

Sir,—We have a fall from 1st December to the 6th of 4°, then a rise to the 18th of 4°; *can* these variations be caused by the effect of the sun's rays? Twice in December, 1869, have I seen a heavy fall of rain, and the next day *dust flying in the roads*. Has any one ever

[1] Announced a few weeks since in our "Notes."—Ed. *S. O.*

before seen such a thing? To-day (3rd January, 1870), my mercury is 41°, again a rise of 3°.

December, 1869.

1	44°	6 and 7	40°	23	43°
2	43°	8 and 9	41°	24	42°
3	42°	10 to 14	42°	25 to 27	40°
4 and 5	41°	15 to 17	43°	28 to 31	38°
		18 to 22	44°		

In December, 1868, the temperature was only observed weekly, it was on the

7	48°	21	47°
14	46°	28	46°

Yours obediently,

Havant, January 3. C. J. B.

METEOROLOGY OF DECEMBER, 1869.—*From* F. B. FALKNER.

SIR,—I beg to send you a few particulars of the weather of last month, as deduced from observations conducted by myself in this neighbourhood. The circumstances of atmospheric temperature and moisture refer to a stratum of air 4 ft. from the ground. The barometer is 335 ft. above sea-level. The *solar* thermometer has its bulb blackened and inclosed in a "vacuum" glass chamber, at about 3½ ft. from the ground. The *radiating* thermometer rests horizontally on a table 3 ft. from the ground, and is freely exposed to the sky; it is used to measure the lowest temperature to which unsheltered vegetation is exposed at night, near the earth's surface.

I am, Sir, your obedient servant,

F. B. FALKNER.

Appleby Grammar School, Leicestershire, Jan. 8.

GENERAL RESULTS.

Mean maximum temperature of air	41·1°
Mean minimum temperature of air	29·8°
Mean diurnal range of temperature of air	11·3°
Highest temperature of air, on the 18th	53·9°
Lowest temperature of air, on the 29th	9·4°
Total range of temperature of air	44·5°
Mean temperature of air	35·6°
Mean temperature of dew-point	33·0°
Highest (*observed*) reading of dew-point, on the 18th	49·0°
Lowest (*probable*) reading of dew-point, on the 29th	9·0°
Highest minimum air-temperature of 24 hours, on the 19th	37·4°
Lowest maximum air-temperature of 24 hours, on the 28th	26·0°
Highest reading of thermometer at 9 a.m., on the 19th	49·9°
Lowest reading of thermometer at 9 a.m., on the 28th	17·3°
Highest reading of "solar" thermometer, on the 29th	74·0°
Lowest reading of radiating thermometer, on the 29th	0·5°

[It is to be observed that these two extreme readings occurred within the same period of 24 hours.]

Mean humidity of the air	·91
Mean weight of water in a cubic foot of air	2·2 grs.
Mean height of the barometer	29·456 in.
Total observed range of the barometer	1·740 in.
Rainfall	3·420 in.
Number of days on which rain or snow fell	17
Number of frosty nights	15
Number of days that were frosty at 9 a.m.	9
Number of days that were frosty throughout	2
Number of days on which the thermometer rose above 45°	7
Number of days on which the thermometer rose above 50°	4
Number of nights on which the thermometer fell below 25°	7
Number of nights on which the thermometer fell below 20°	3
Number of nights on which the thermometer fell below 15°	2
Number of nights on which the thermometer fell below 10°	1

In the lower regions of the atmosphere, southerly winds were more frequent than northerly in the proportion of 8 to 7; and westerly were more frequent than easterly in the proportion of 5 to 3. Snow fell on several days, but the greatest falls were on the 22nd and the 27th. Cloud was, generally, very prevalent; but there was, perhaps, rather less fog than is usually observed in the month of December.

The total rainfall for the year 1869, has been 28·74 in., distributed as follows amongst the different months:—

1869.	In.	1869.	In.
January	2·64	July	0·71
February	2·49	August	2·30
March	1·89	September	3·65
April	2·21	October	1·23
May	4·88	November	2·12
June	1·20	December	3·42

This fall is about 4¾ in. in excess of the *average*.

AURORA BOREALIS.—*From* THOS. G. ELGER.

SIR,—An unusually fine auroral display was observed here on the evening of the 3rd inst. Shortly after six a deep crimson glow overspread the northern sky, and numerous streamers, apparently convergent, shot up from the horizon: at 6.20 a very bright and persistent ray in the N.N.W. extended as far as β Draconis. A lull then ensued which lasted till 6.30, when other streamers, brighter than the first, but not so decidedly ruddy in hue, succeeded; one of these bright beams was at least 4° in breadth, and could be traced to γ Ursæ Minoris. Between 6.30 and 6.40 the glow became more intense and many streamers, alternating with *dark* streaks, were noted. At 6.45 the appearance of the sky was magnificent, the deep red glow forming a fine contrast with a few scattered black clouds which had drifted from the south-west over the northern horizon. At 7.5 the crimson colour gave place to a subdued hue of creamy white, and the streamers increased in number: a notable one was remarked in the N.N.W. at 7.8, which appeared to be about 2° in breadth, and could be traced through Cassiopeia nearly to the zenith. At 7.20 the sky was partially overcast, ill-defined patches of cloud stretching across the northern quarter; *between* these the glow assumed the deep crimson hue remarked during the early part of the display, while above and below the auroral light retained its dawnlike appearance.

No traces of arch or corona were observed, and had it not been for the streamers the Aurora might have been easily mistaken for a large fire in the neighbourhood.

The azimuthal limits of the glow were from N.W. to N.E., and some idea of its intensity may be gathered from the fact that during the height of the display, the light of the brightest stars, between the northern horizon and 40° of altitude, was obliterated. The glow continued to be visible till ten o'clock, but no streamers were observed after 7.15.

I am, &c.,

Bedford, Jan. 5. THOMAS G. ELGER.

MR. MARTIN'S "MICROSCOPIC OBJECTS."—*From* MR. J. H. MARTIN.

SIR,—I admire the review of my work for its honesty; but must inform you that I never set out for beauty, or fineness, such as professional engravers use. My object was and is, *faithfulness*, and correct appreciation of the object.

Trusting that you will notice this, and kindly review the future numbers in the same honest spirit, Faithfully yours,

Maidstone and Mid Kent Natural History Society, Jan. 10. J. H. MARTIN.

SIR W. THOMSON *versus* MR. MENTEATH.—*From* A YOUNG BEGINNER.

SIR,—Is not Mr. Menteath somewhat hasty when he heads his last letter, "Sir William Thomson *versus* Geology"? If I remember rightly, Sir W. Thomson only assailed certain theories in geology; but Mr. Menteath seems to imply by this, that *all* geology is opposed to his opponent, which is the very thing to be proved, and should not be assumed at the outset. Mr. Menteath speaks of "the remarkable absence in geology of any traces of a beginning:" does this mean the beginning of life? If so, is it not hasty? As we pass downwards to the older beds, we regularly lose the different races of plants and animals. We leave mammals at the Trias, reptiles among the coal-measures, fishes fail us beyond the Upper Silurian, and when we reach the Cambrian zone we find but a few low and scattered organisms.

Now, what evidence would be held to show a beginning? Surely it would be the regular loss of race after race of living creatures as we near the older rocks; if a theorist denies this as an indication of a beginning, how is it possible for him to find traces of any beginning at all? If he refuses to admit the testimony of the rocks, and still persists in stating that no beginning appears, it looks like saying, "Shut your eyes to all traces of a beginning, and you will see none!"

The regular dying out of life as we near the earlier Cambrians cannot be overlooked, especially when we consider that their foreign equivalents (the Huronian in Canada and the Swedish formations) tell the same tale; and that the thickness of these beds is immense. Sir R. Murchison has shown that the earlier Cambrians are admirably adapted for preserving organisms, and surely so wide-spread a paucity of life was owing to some *special* cause. If the evidence of palæontology is not correct at this place, where in all geology can it be relied on? and why do we make use of such terms as "age of reptiles," "age of coal," or such-like?

If the paucity of life in the earlier beds be not owing to the fact that comparatively few organisms were then in being, I would ask, To what *was it owing?* and can any other cause capable of bringing about such a result be *clearly proved* to have operated at that time?

I know it will be said, "The geological record is too imperfect to show a beginning, and future search will probably find new and older races." But the question is not what geology *might* or *may* show, but what it *really does* show; and he who appeals to geology *as it is now*,

must be answered from geology *as it is now*. I should also wish to know if the statement that the geological record "may represent but a *trifling fragment* of the history of the earth" rests on *definite proof*, or merely on supposition.

Mr. Menteath seems to object to any limit to geological time—I venture to ask why? Professor Phillips calculates the age of life on the globe at between thirty-eight and ninety-six millions of years; another very eminent geologist estimated that all the denudation testified to by the strata, and the erosion of valleys, might have taken place *several times* in a hundred million years. Does Sir W. Thomson say more? and why should those who are not Darwinians wish for longer time than this?

Does not the very form of the earth lead us to infer a beginning? I certainly do believe this form *was* acquired by consolidation from a state of fusion, and I do not know how Mr. Menteath can explain it by denudation; but he merely asserts, and does not prove this.

I put forward these views with much diffidence, being but a beginner in geology; but I, too, would be encouraged by a hope of striving for the right. I inclose my name and address.

Yours truly, A YOUNG BEGINNER.

SCIENTIFIC EDUCATION FOR WOMEN: A QUERY.—*From* M.A. (Camb.).

SIR,—I have been asked by a lady who reads SCIENTIFIC OPINION to ascertain whether the Hackney Scientific Association provides lectures on scientific subjects, and in case such lectures are given, whether they are open to both sexes.

She also wishes to know whether, if she visits the South Kensington Museum, she could inspect, without a special order, the Educational books sent to that Museum by the leading publishing firms.

The lady on whose behalf I make these inquiries is engaged in a training school for governesses, and she wishes to know whether the College of Preceptors or any other educational body has ever published —what should certainly be a great boon—a list of really trustworthy school books.

Jan. 5. M.A. (Camb.).

RAILWAY IMPROVEMENTS.—*From* SAMUEL BARBER.

SIR,—The difficulty of effecting any improvement in railway management or machinery seems to deter many, of whose ingenuity the public might now be reaping the fruit, from devoting their attention to the subject. The result is so serious that I venture some further remarks on the cause of the mischief.

The charge of selfishness made against the engineers need scarcely be noticed. Do not nine men out of ten in all professions endeavour to manage the concern committed to them so as to make the golden stream flow in their own direction? And the ready admission of novelties in mechanism, &c., would be considered a fair ground for an imputation of inferior ability at least. I am told that more than one invention has been patented for effecting the object referred to in my letter of Sept. 22, 1869, but that there is no demand for such improvements! I may, therefore, be excused, perhaps, from spending time on the elaboration of another.

The real cause of the misfortune seems to lie in the general ignorance of engineering among directors. They are at the mercy of their engineer. So much the worse for the public. For it must be noted that the *ultimate* perfection of the railway system, and, by consequence, the general welfare of the people, are not necessarily aimed at by the engineers, who naturally, and justly too, have regard to local considerations and private interests—the duties of their position, in the present patch-work system, rendering this incumbent upon them.

Is there not here a fair ground for Government interference?

Yours, &c.,

Aigburth, Liverpool, Jan. 5. SAMUEL BARBER.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THE following papers have been read since our last report and should have been published by us, but for the reason explained last week in our "Answers to Correspondents":—"Researches into the Constitution of the Opium Bases. Part III. On the Action of Hydrochloric Acid on Codeia," by Augustus Matthiessen, F.R.S., Lecturer on Chemistry in St. Bartholomew's Hospital, and C. R. A. Wright, B.Sc.—The authors describe the methods used in obtaining a new base which they call Chlorocodide. "On the Action of Cyanogen on Anthranilic Acid," by P. Griess, F.R.S.—The author describes a new base "On the successive Action of Sodium and Iodide of Ethyl on Acetic Ether," by J. Alfred Wanklyn, F.C.S., &c.; communicated by Professor Williamson. "On the Action of Bromine upon Ethylbenzol," by T. E. Thorpe, Ph.D., was a chemical paper of considerable length, communicated by H. E. Roscoe, Ph.D., F.R.S. "On Abstract Geometry," by Professor Cayley, was a very abstract mathematical paper.

"On Approach caused by Vibration," by Frederick Guthrie.—The author observes that when a vibrating tuning-fork is held near to a piece of cardboard, the latter has a tendency to approach the fork. Starting from this experiment, a series of experiments is described having for their object the determination of the cause and conditions of the fundamental observed fact. It is shown that no sensible permanent air-currents, having their source at the fork's surface, are established; and hence that the approach of the card to the fork is not due to the expansion of such currents as in M. Clement's experiment. The modifications are examined which Mr. Faraday's surface-whirlwinds on a vibrating tuning-fork, undergo when the fork vibrates in the neighbourhood of a sensibly rigid plane. It is shown that a delicately suspended card approaches the fork when either of the three essential faces of the fork is presented to the card, and that the approach takes place from distances far exceeding the range of Mr. Faraday's air-current. That the action between the card and fork is mutual is shown by suspending the latter. Also, one vibrating fork tends to approach another in whatever sense their planes of vibration may be towards one another. The mean tension of the air surrounding a vibrating fork is examined by inclosing one limb of the fork in a glass tube. It appears that the vibrating fork displaces air. The question whether the equilibrium between two equal and opposite forces acting on a body is disturbed by submitting one of the forces to successive, rapid, equal, and opposite altérations in quantity, is answered in the negative by an experiment which shows that the equilibrium of a Cartesian diver is not disturbed by submitting the water in which it floats to vibration. Various modifications are introduced into the nature of the surface which receives the vibrations, such as making it a narrow cylinder with one end closed, making it of cotton-wool, &c. It is found that in all cases the suspended body approaches the vibrating one. The author concludes that the effect of apparent attraction is due to atmospheric pressure, and that this pressure is due to undulatory dispersion. It is suggested that the dispersion of the vibrations which constitute radiant heat may cause bodies to approach,—being pushed not pulled.

Thursday, January 6th.—"Account of the Suez Canal, in a Letter to the President," by J. F. Bateman, Esq., F.R.S.—The following letter, received December 15th, 1869, was read:—

16, Great George-street, Westminster, 15th December, 1869.

MY DEAR SIR EDWARD,—On my return from the opening of the Suez Canal, where, by your kind selection, I had the honour of representing the Royal Society as the guest of the Viceroy, I think it incumbent on me to give a short account of my journey and my impressions of the great and important undertaking which was so magnificently inaugurated.

Nothing could exceed the splendid hospitality of the Viceroy, who had in every possible way provided for the accomodation and the comfort of his guests. The crowd of visitors, however, was so great, and his own personal attendance was so constantly given to the Empress of the French, the Emperor of Austria, and other royal personages who honoured him with their company, that it was almost impossible to bestow any special attention to other individual guests; but few or none could complain of any want of attention or of any material inconvenience.

I was fortunate in being present at every important point and on every important occasion, and in receiving all the civilities which might be considered due to the representative of the Royal Society.

Of the work itself I have no hesitation in pronouncing it a decided success—not all that could be desired, nor all that was promised, and very far from being finished, even on the contracted scale on which it has been executed. A reef of rocks at Serapeum, extending for about 85 mètres in length, at a depth of 16 or 17 ft. below the surface of the canal, and which was not discovered till just before the period fixed for the opening, at present limits the draught of the vessels which can use the navigation. There are some objectionable curves and narrow places, and many miles of unprotected slopes, all of which must be improved or remedied before the canal can be placed in a satisfactory position. Still, in its present state, vessels drawing not more than 16 ft. can pass from end to end with facility and safety; and when the rocks alluded to are removed, this depth will be increased to 23 or 24 ft.

The total length of the canal from Port Said to Suez is 99 miles; it varies in width from 196 ft. to 327 ft., having, however, in each case a width of 72 ft. in the centre, 26 ft. deep, the slopes on each side of this centre-width varying with the character of the material cut through. Near Port Said, and through the shallow lake of Mensaleh, the material is very sandy, and here and elsewhere, under similar cir-

cumstances, the slopes must be protected by stone pitching or facing, or they will wash down by the action of passing vessels, and the material which will thus be deposited in the bottom of the canal must be narrowed by dredging. Going south, the material generally becomes more argillaceous and stony; and here the slopes will be much more easily maintained, though nearly throughout the whole length of the canal some stone protection at the level of the water will be required.

Before reaching Lake Timsah, which lies about midway between Port Said and Suez, the canal passes through the deepest cutting of El Guise. At its greatest depth this cutting is 85 ft. to the bottom of the canal. The lower part of this cutting, at and a little above the level of the water, consists of soft clay, above which is a concreted mass of shells and sand; and this is covered by loose sand, which is liable to be acted on by the wind. The canal here is curved and narrow, and ought to be improved in both respects.

It is again restricted in width through the deep cutting at Serapeum; but here the material is argillaceous and strong, and the slope will be easily maintained in shape.

From the Bitter Lakes to Suez it is a wide, noble, and well-finished canal.

Out of the whole length, nearly 30 miles are through Lake Timsah and the Bitter Lakes, 5½ miles in the first, and 23½ in the latter. In these lakes a deep channel has been dredged out, which is marked by buoys and stakes. These vast sheets of water in the midst of the Desert, on which so many noble vessels were floating, had been but a few months before mere dry depressions, covered by a stratum of salt. The filling them with water commenced in February from the Mediterranean, and in July from the Red Sea. They were filling by the beginning of October, thus belying one of the many unfavourable prophecies, that the absorption and evaporation would be so great they would never fill at all, or, if they did, the current inwards in both directions would be so great as to be destructive of the canal.

On our voyage through there was a current against us towards the Mediterranean from Port Said to near Lake Timsah. We anchored about ¾ mile from the end of this portion of the canal, and at daylight the next morning there was a current in the same direction of nearly 1½ miles an hour. The time of starting from Lake Timsah was purposely delayed till near midday, that we might have the tide from the Red Sea against us, and deep water over the rocks at Serapeum. The current towards Lake Timsah was strong; and on the following morning, between the Bitter Lakes and Suez, it ran at 3½ miles per hour, but a strong southerly wind accompanied the tide. We had no opportunity of making observations ourselves, or of obtaining information; but my impression is that at this season of the year there is on the average of the day a regular current from the Red Sea to the Mediterranean.

The range of the tide in the Mediterranean is at most but about 20 in., while in the Red Sea at Suez it varies from 4 to 6 ft.

On the day of the opening thirty-two vessels reached Lake Timsah without let or hindrance; one Egyptian vessel, the *Garba*, coming after this number, stuck fast for some hours about 12 miles from the Lake, and retarded a number of vessels in its rear. All, however, eventually came forward, and the mighty fleet assembled on Lake Timsah the following day.

At Port Said a good deal requires to be done. The westerly jetty, which projects into the sea for about 2,700 yards, and which has been erected for the purpose of forming a harbour, and of intercepting the sand and alluvial matter which is drifted from the mouth of the Nile eastwards, is too light and too open effectually to answer the purpose. Close in shore a considerable amount of this drifting sand has been arrested, and there is already an accumulation of dry ground where the sea was very recently. On the land thus created were erected the temple in which the Viceroy received his principal guests at the inauguration; and the temples for the worship of the Mussulman and Christian Churches, where all the religions of the world were supposed to be present and to ask a blessing on the great undertaking the opening of which they were assembled to celebrate. In its present condition, the jetty favours the deposit of material within the harbour; and not until it is rendered impervious to the passage of the sand through the interstices of the concrete blocks of which it is formed, will there be any effectual protection against the silting up which is taking place. Perhaps by degrees an inner bank or shoal may be formed, which would answer the purpose of a breakwater; but this would create a crooked and inconvenient channel, and would be ineffective towards the seaward end of the jetty. The company will no doubt see the necessity of completing the necessary works here and elsewhere. The harbour and portions of the canal will require pretty constant dredging for some time; but in my opinion neither this nor any other work will entail any very serious expense in maintenance. The cost of the whole undertaking is stated to have been about £16,000,000 sterling; and it may require from £2,000,000 to £4,000,000 still to complete the work satisfactorily on its present scale of dimensions; but interest has to be paid at present on only about half of the capital at present raised.

Many gentlemen who are competent to form sound opinions on this point believe that the traffic will be quite sufficient to pay all cost of maintenance and handsome dividends; but I am not sufficiently well informed to hazard any conjecture on the purely financial part of the question. In an engineering point of view I consider it a great and most important undertaking—great, however, only as respects its magnitude and the country in which it has been executed. There is not a work of art or of difficulty from one end to the other; but there have been about 80,000,000 cubic yards of material excavated, and nearly 10,000 labourers employed in the works. For their sustenance, and before the works could be carried on with any vigour, sweet water had to be brought from the Nile at Cairo, and distributed along the whole length of the canal. This work was in itself one of considerable magnitude. It is a navigable canal from Cairo to Ismailia, and from thence to Suez. From Ismailia to Port Said and intervening places, the fresh water is conveyed in pipes. The fresh water has been applied to irrigation, the fertilizing results of which are already visible, and it is no doubt destined to perform an important part on the improvement of the country.

The undertaking must be regarded as a great work, more from its relation to the national and commercial interests of the world than from its engineering features. In this light it is impossible to overestimate its importance. It will effect a total revolution in the mode of conducting the great traffic between the East and the West, the beneficial effects of which I believe it is difficult to realize. It is in this sense that the undertaking must be regarded as a great one; and its accomplishment is due mainly to the rare courage and indomitable perseverance of M. Ferdinand de Lesseps, who well deserves the respect he has created and the praises which have been bestowed. By cutting across the sandy ligaments which have hitherto united Asia and Africa, a channel of water communication has been opened between the East and the West which will never again be closed so long as mercantile prosperity lasts or civilization exists.

I cannot close this letter without expressing my obligations to Mr. Pender, Chairman of the Eastern Telegraphic Companies, who courteously entertained me, with other friends, on our passage through the canal on board the *Hawk*, a steam corvette belonging to the Electric Telegraph Construction Company, which had been placed at his disposal. On board this vessel was assembled a small body of distinguished and intelligent gentlemen, who had more than usual opportunities of obtaining such information as time and circumstances afforded.

I have the honour to remain,
Very truly and faithfully yours,
JOHN FRED. BATEMAN.

Lieut.-General Sabine, P.R.S., K.C.B.

LINNEAN SOCIETY.

DECEMBER 19TH, 1869.—G. Bentham, Esq., president, in the chair. It was announced that a new part of the *Transactions* containing Dr. Welwitsch's Flora of Angola and Benguela, with numerous plates, was just ready for distribution. The following papers were read:—"On a Species of Ipomœa, affording Tampico Jalap," by Dr. Hanbury, Esq. In this paper the author gave some account of a species of jalap recently imported from Tampico, and distinguished in commerce as Tampico jalap. This drug he stated to be derived from a new species of Ipomœa, for which he proposed the specific name of *simulans*, in allusion to the resemblance which it bears to the true Jalap plant (*Ipomœa purga*). "On the Necessity of a Reform in the Generic Nomenclature of Diurnal Lepidoptera, by a review of the genera proposed from the time of Linnæus to the year 1816," by W. F. Kirby, Esq.; communicated by H. T. Stainton, Esq. "A Catalogue of the aculeate Hymenoptera and Ichneumonideæ of India and the Eastern Archipelago, with Introductory remarks by A. R. Wallace, Esq.," by F. Smith, Esq.; communicated by W. Wilson Saunders, Esq.

CHEMICAL SOCIETY.

THURSDAY, DECEMBER 16TH, 1869.—Dr. A. W. Williamson, F.R.S., &c., president, in the chair. The minutes of the previous meeting having been read and confirmed, the following certificates were read:—For the first time: Pedlar, Royal College of Chemistry. For the second time: James Bell, Howell Hill, Ewell; G. R. Hislop, Gasworks, Paisley; William Ladd, Beak-street, Regent-street; Alfred Bird, Worcester-street, Birmingham; H. Seward, 15, Barnsbury-park, N.; Edwin Lepper, 11, Maiden-lane, Queen-street, Cheapside, E.C. For the third time: Samuel Jefferson, Secretary to the Yorkshire Board of Education, Woodville-terrace, Woodhouse-lane, Leeds; Clements Higgins, Demonstrator of Chemistry, King's College, London; James John Bourey, Analytical Chemist, 10, Stepney Causeway, E. The last-named gentlemen were balloted for and duly elected.

Mr. McLeod gave a verbal account of some experiments he had made on the presence of gases in sea-water. At the last meeting he had stated from memory that Thames water contained 6 volumes of

gas in 100 of water; on referring to his note-book he found that 100 volumes of this water contained: Nitrogen, 1·398; oxygen, 0·619; carbonic anhydride, 4·180; giving a total of 6·197 volumes in 100 volumes of water. He had experimented upon some sea water collected at Worthing, some distance from the outfall of any river, and which had been exposed to the air for twenty-one months, and found that the amount of gas in 100 volumes was: Nitrogen, 1·104; oxygen, 0·572; carbonic anhydride, 2·620; the total being 4·296. This was very much in excess of the quantity found by Mr. Hunter, as recorded in his paper read at the last meeting, but the quantity of carbonic anhydride was much smaller than might have been expected. The hardness of sea water was greater than that of Thames water, and therefore one would expect a larger quantity of anhydride to have been produced by the distillation. He intended, if possible, to collect some water from the surface of the sea, and to ascertain what quantity of gas it contained.

The president, in thanking Mr. McLeod for his communication, said Dr. Hugo Müller had, he thought, made experiments on the condition of carbonic gas when dissolved in water which led to remarkable results.

Dr. Hugo Müller, in experimenting on the manufacture of soda-water in an apparatus which was formerly much used, found that if the carbonic acid remained in contact with the water for twenty or twenty-four hours, it disengaged itself gradually, adhered to the sides of the glass, and appeared altogether different than when it was left only a short time in contact with the water. He had also noticed that, with the addition of a little common salt, the carbonic acid dissolved much quicker, the chloride of sodium being actually decomposed by the carbonic acid, hydrochloric acid, and bicarbonate of soda being formed. He had proved the presence of hydrochloric acid, by ultramarine, which was neither acted upon by carbonic acid nor chloride of sodium. Another instance, in which the chloride was decomposed by carbonic acid, was when carbonic acid was passed through a neutral solution of chloride of lead. In a short time, a clear solution was obtained, and, after a certain time, a precipitate consisting of chloro-carbonate was formed.

Dr. Divers observed that, if rectified spirit were mixed with distilled water which contained air through exposure, a kind of effervescence occurred, which he supposed was due to the formation of minute bubbles of air being liberated and rising to the surface. This seemed to show that a mixture of spirit and water had less solubility for air than pure water itself.

The president wondered if the temperature had anything to do with the peculiar state in which Dr. Hugo Müller found the carbonic acid. He had been looking over Dr. Andrews's experiments on the states of carbonic acid at different temperatures, and it would seem that a few degrees of temperature made a great deal of difference in the proportion of the acid, which was not overcome by enormously multiplying the pressure. The observations on the greater solubility of carbonic acid in water containing sodic chloride he thought of great theoretical value, confirmed as they were by the ultramarine test. He (the president) had held, for years, that salts generally dissolved in water by decomposition, and he was interested to find his view confirmed by the introduction of the ultramarine test for the presence of free hydrochloric acid.

After some further remarks from Dr. Hugo Müller, on the chloro-carbonate of lead reaction,

The president alluded to a reaction he had published twenty-four or twenty-five years ago—viz., the action of chlorine in water in the presence of salts like sodic sulphate.[1]

ANTHROPOLOGICAL SOCIETY OF LONDON.

At the meeting held on January 4th, Dr. R. S. Charnock, V.P., in the chair, the following new fellows were elected:—Andrew Black, Esq., John Morgan, Esq., Carl Alphonse Hoffman, Esq. It was announced that Mr. Brabrook and Mr. A. L. Lewis had been appointed auditors of the accounts of 1869, for the annual statement on the 18th inst. A paper by Mr. L. Owen Pike M.A., "On the Psychical Elements of Religion," was read. The author premising his remarks by a definition of terms, pointed out the sense in which he employed the term "religion," "psychical," and "element," and the twofold division of the term "religion." He then discussed the elements of popular creeds; the religion which appeals to the emotions, and to the intellect; the religion of the astrologers; astrology and mythology; the personification of natural objects and forces; the personification of human passions and human faculties; the explanation of brute worship; the worship of humanity, suggested by a sense of dependence; and a statement of the emotional and intellectual elements discoverable in all popular creeds. Then, turning to the elements of philosophic creeds, he commented on the failures of philosophers, the causes of which failures were discovered by Buddha; the connecting links between philosophic and popular creeds; the part played by language in forging these links, and the delusions of linguistic origin in the use of various philosophical terms. He asserted that the human intellect is frequently misled by symbols of its own creation; that the terms "infinite," "the finite," and "the infinite," as commonly used by philosophers, are meaningless. He pointed out the difference between the philosophical and the mythological processes of personification, and that the origin of meaningless philosophical terms was explained by the laws of the intellect. Finally, he stated the result of a psychological search for a basis of religion, *i.e.*, that the unaided intellect cannot, in this search, pass beyond the knowledge of the law of Relativity—the great fundamental law of the mind. The recognition of this law may, in a certain sense, be considered a religion, or a part of a religion. In the discussion on the above paper, the following gentlemen took part:—The Rev. Dunbar Heath, Mr. Dibley, Mr. Dendy, Mr. Charlesworth, Mr. Macrae Moir, Mr. Moncure Conway, Mr. Reddie, Mr. Sprague, and Dr. Carter Blake.

[1] From the *Chemical News*.

ROYAL HORTICULTURAL SOCIETY.

December 21st, 1869.—W. W. Saunders, Esq., F.R.S., in the chair. The preliminary business of the meeting being concluded, the Rev. J. Dix announced the awards of the Floral Committee, and G. F. Wilson, Esq., those of the Fruit Committee. The Rev. M. J. Berkeley then stated with reference to the species of Abies alluded to at the last meeting under the provisional name of *A. japonica*, that on comparison with specimens in the Kew Herbarium he had ascertained that Mr. Standish's plant was the *A. obovata* of Ledebour. He regarded the sharp-leaved form of *A. Pinsapo* as being produced by the sterile tree, the blunt leaves being produced by the cone-bearing tree. A similar difference had been observed in other Conifers, as the *Picea firma*, the sterile form of which had been called *P. bifida*. Mr. Berkeley stated that 200 collections of seeds of species of Cratægus and allied genera had been collected at Chiswick for distribution among the fellows.

Attention was next directed to some specimens of Maize grown at Chiswick, a full report upon which will be given in the society's *Journal*. The best variety was that known as Bates's Early Bronze, which was the same as that shown by Mr. Dancer at a former meeting; but it was remarked that none of the trials made in cooking the green cobs had been successful. Williams's Archimedian Lawn Mower, which had been sent to Chiswick for trial by the editors of the *Gardeners' Chronicle*, was stated to have met with great approval.

A letter from W. E. Hubbard, Esq., of Leonard's Lee, offering a prize, was then read, on which the chairman and Mr. Bateman made a few remarks. Mr. Bateman also alluded to specimens of the double Cocoa-nut, *Lodoicea sechellarum*, and of the Sago Palm, presented to the society by Mr. Fernyhough, Belsize Park, Hampstead, who also exhibited coloured drawings of various tropical fruits grown in Mauritius.

A few remarks were then made upon the Orchids, including the beautiful white variety of *Lælia anceps*, named Dawsoni, and a supposed new species of Polycycnis, proposed to be named after Professor Reichenbach.

Attention was also called to the new *Hippeastrum Leopoldi*, named after the King of the Belgians, on the occasion of his recent visit to South Kensington. Notice was given that the meetings in the following year would be held on Wednesdays, instead of on Tuesdays, as heretofore.

Scientific Committee.—Mr. W. W. Saunders in the chair. The secretary, Rev. M. J. Berkeley, exhibited a leaf of Acrides "fox-brush" with a peculiar form of spot differing from any he had previously seen. Mr. Laxton sent specimens of peas of the most varied character, the result of a single cross, further particulars of which will be given hereafter. A very interesting paper "On the Fertilization of Grasses," from Dr. R. Spruce, was communicated through Dr. Masters. The paper had reference to the statement of M. Bidard, that grasses are usually self-fertilized while in the bud, and will be found in great part among our articles [see p. 33].

Mr. Saunders alluded to the circumstance that the dead bodies of a species of fly might occasionally be found imprisoned in the flowers of *Lolium perenne*, as if the plant exerted some poisonous influence on the insect.—Mr. A. W. Bennett stated, as a result of his observations, that it is impossible to predicate of any given family whether its members are self or cross fertilized. In the same group some species may be cross fertilized, others self-fertilized. Many winter-flowering plants are self-fertilized, and amongst them the common *Poa annua*. Mr. Horne stated that in India different varieties of maize remain constant, even though grown in adjacent fields, so that it would seem as if no crossing took place in this instance.

A conversation then ensued as to the best method of conducting in future the meteorological observations at Chiswick, when Mr. Glaisher stated that he would be willing to reorganize the system of observation in such a manner as to introduce the requisite changes, without imparing the value of the record kept at Chiswick for upwards of 40

years. In reference to ground temperature he stated that at a depth of 25 ft., the ground was coldest in July, and warmest in January.

INSTITUTION OF CIVIL ENGINEERS.

The annual general meeting was held on the 21st ult., Charles Hutton Gregory, Esq., president, in the chair. In reviewing the events of the past twelve months, completing the fifty-second year since the foundation of the institution, the council stated that the proceedings had furnished corroborative evidence of the sound basis on which the society was established,—a basis which had been taken as the model for many analogous institutions, both at home and abroad.

Referring to the business at the ordinary general meetings, of which there were twenty-two during the past session, the council gave a retrospect of the valuable labours of the society during the past session. The thanks of the meeting were unanimously accorded to the president for his zealous efforts in the interests of the institution; to the vice-presidents and the other members and associates of council for their co-operation with the president, and their constant attendance at the meetings; to Mr. Charles Manby, honorary secretary, and to Mr. James Forrest, secretary, for the manner in which they had performed the duties of their offices; as also to the auditors of the accounts, and to the scrutineers of the ballot for their services.

The following gentlemen were elected to fill the several offices on the council for the ensuing year:—Charles Blacker Vignoles, president; Joseph Cubitt, Thomas Elliot Harrison, Thomas Hawksley, and George Willoughby Hemans, vice-presidents; James Abernethy, William Henry Barlow, John Frederic Bateman, Joseph William Bazalgette, Nathaniel Beardmore, Frederick Joseph Bramwell, James Brunless, John Murray, George Robert Stephenson, and Edward Woods, members; and Edward Middleton Barry, and Lt.-Col. Andrew Clarke, C.B., R.E., associates.

CHRISTMAS LECTURES AT THE ROYAL INSTITUTION.

A series of six lectures adapted to a juvenile auditory is annually given at the Royal Institution during the season of pantomimes and Christmas parties. This time Professor John Tyndall had allotted to him the choice of a subject, and the task of instructing the young folk. He chose "Light" for his subject, and performed his task in a manner which betrayed the man as much as the philosopher. There was a marked absence of abstruse scientific arguments—such arguments as impress people strongly with their utter ignorance and their incapacity for understanding scientific subjects. Professor Tyndall's lectures were an almost uninterrupted series of experiments, keeping the eyes of his listeners open at all events. Some of these experiments were really striking. Faraday and Newton himself would have been delighted had they witnessed the brilliancy of colours produced by a transparent film, such as was shown in one of the lectures. We are referring to the enormous soap-bubble (or rather a bubble made by means of glycerine and oleate of soda), on which the lecturer himself had experimented but the day previous for the first time. This bubble, when in contact with a beam of monochromatic light, produced effects not unlike the fiery flashes of an Aurora borealis at times; while at other moments the softest hues of spectral colours were thrown on the screen.

On the whole, the treatment of the subject was undoubtedly in able hands, and, except at Professor Dove's lectures, we have rarely met with a like handling of the matter and the audience alike. The Prussian professor's application of the "reversion prism" to the astronomical telescope, received due appreciation at the hands of his English colleague, who stands in a somewhat similar position here to what Dove stands at Berlin.

Professor Tyndall is peculiarly happy and prolific in his illustrations. The sea-fowl, he says, as the waves pass it, is not carried forward, but moves up and down. Here is another elucidation of the fact that the wave-motion is not a motion onwards, but a motion of the individual particles up and down, or rather describing closed curves. His experiments with the invisible rays of heat alone, obtained by intercepting the luminous rays, were remarkable, though not new. Radiant heat has been treated by Professor Tyndall in a masterly manner during the last nine years. He gave the term "caloriescence" to the scientific world, and his name will ever be coupled with the remarkable discoveries made in that department. In his experiments for rendering a refractory body incandescent by invisible rays, he uses as a filter a solution of iodine in bisulphide of carbon, and he succeeds admirably in producing combustion, fusion, and incandescence at the invisible focus. During one of the lectures he produced a little stove, a kind of miniature kitchen-range, with a fire all properly laid according to the established craft of our housemaids, but of course not lighted. He brought it near that dark, pitch-dark focus, and behold, it was lit, as if by magic! There was something for wondering youth to take home, something the whole house would understand, though hardly fathom, and possibly discredit. Those belonging to the latter class should go and see.

GEOLOGISTS' ASSOCIATION.

The Ordinary Monthly Meeting was held on Friday evening, January 7th, Professor Morris, F.G.S., &c., president, in the chair. The following paper was read, "On some sections of the Chalk between Croydon and Oxtead with observations on the Classification of the Chalk," by Caleb Evans, F.G.S.—The author described in detail the sections of the Chalk of the North Downs of Surrey exposed in the cuttings on the unfinished line of the Surrey and Sussex Railway, and noted the various fossiliferous beds. He stated that several well-marked life zones could be seen in the course of this line of sections, and proposed the following classification for the Chalk of this district:—

Chalk with bands of Flint.—1st. Purley beds with *Micraster cor-anguinum* and *Inoceramus Cuvieri*. 2nd. Upper Kenley beds with *Micraster cor-anguinum*, *Ananchytes ovata*, and *Spondylus spinosus*. 3rd. Lower Kenley beds with *Micraster cor-bovis* and *Holaster planus*.

Chalk with bands of Marl.—4th. Whiteleaf beds with *Inoceramus Brongniarti* and *Galerites albogalerus*, variety *subrotundus*. 5th. Upper Marden Park beds with *Inoceramus mytiloides* (*labiatus*) and *Ammonites peramplus*.

Yellow Chalk, Grey Chalk, and Chalk Marl.—6th. Lower Marden Park beds with *Belemnitella plena* and *Ammonites varians*.

The author then noticed the classification of the chalk, or the equivalent beds of the continent, proposed by foreign geologists, and published by Mr. Davidson in his "Notes on Continental Geology," (*Geological Magazine*, vol. vi.), and directed attention to the correspondence of the groups well-marked in the Surrey chalk with several of the zones of the upper cretaceous deposits of Northern France, and North-western Germany.

An interesting discussion followed, in which several members took part: observations being made on the distribution of the chalk fossils, the physical conditions of the cretaceous ocean, and the occasional occurrence of layers of coarser material as evidence of drift in the chalk period, and reference was made to the recent and former dredgings in the bed of the Atlantic as bearing on the origin of the chalk, in showing the analogy of the corals, bryozoa, and abundance of foraminifera in both deposits, and also the occurrence of drifted coarse sands, some of volcanic origin, noticed in some of the late dredgings.

VICTORIA INSTITUTE.

An ordinary meeting was held on Monday, Jan. 3, at No. 8, Adelphi-terrace, Mr. Reddie in the chair. A paper was read on "The Origin of the Negro," by the Rev. J. H. Titcomb, M.A. The following is an extract. After describing various structural peculiarities, the writer proceeded:—The problem which ethnologists have to solve is, How were these structural peculiarities originated? To this question five answers may be given:—1. By an act of independent and separate creation. 2. By a miraculous judgment on the person of Canaan. (See Gen. ix. 25.) 3. Through the action of food, climate, and other external causes. 4. Through the principle of methodical selection, by which new varieties of animals are often artificially produced. 5. Through the operations of natural selection, after some unexpected appearance of a congenital variety bearing this peculiar Negro character.

On the last named, it was remarked:—Assuming, therefore, that the Negro variety sprang up through some abnormal prototype, we have (in various cases mentioned) a rational and just foundation for the theory. Nor can the idea be called either novel or unscientific. Lawrence, for example—just as Huxley in relation to polydactylism—suggests the possibility of our applying this inheritance of abnormal varieties to the formation of new types of mankind. "Let us suppose," says he, "that the Porcupine family had been exiled from human society, and been obliged to take up their abode in some solitary spot or desert island. By matching with each other a race would have been produced more widely different from us in external appearance than the Negro. If they had been discovered at some remote period, our philosophers would have explained to us how the soil, air, or climate had produced so strange an organization; or else would have demonstrated that they must have sprung from an originally different race; for who would acknowledge such bristly beings for brothers?"

We are, therefore, now brought up face to face with what appears to me to be the most satisfactory solution of the problem placed before us. One can see in a moment, as I showed in the last division of this paper, how a new variety of mankind might be thus artificially produced by means of the continued and methodical selection of abnormal pairs, care being taken to get no dilution of blood through recurrence to the original stock. But the difficulty is to apply such a state of things to the nature of the case; for, as I have before remarked, common sense teaches us that this is the very process which would naturally be most avoided under all such instances of mal-

formation. Consequently, if the negro characteristics are to be considered as an abnormal deviation from the more ordinary types of mankind, originated through some strange and unexpected birth, we must account for their transmission and perpetuation, not on the principle of methodical, but of natural selection. We must show, that is to say, how circumstances may have arisen under which these characteristics could not but have become perpetuated, even in spite of a desire to obliterate them. In other words, we must show how certain conditions of existence may possibly have acted upon man in an early period of the world's history, by means of which Nature herself may have forced forward selective breeding, and in that manner may have indirectly brought about exactly the same results as those which would have been produced through methodical selection.

For this purpose we must revert to those prehistoric periods of the human race in which its primary migrations commenced, and when the first physical varieties of man began to appear. Most of the simple varieties were, I doubt not, rapidly developed by means of climate, food, location, and all those other external forces, within the range of which the wandering hosts were driven; exactly in the same sort of way as certain natural varieties of the wild animals were originated. The tigers, for example, now so diverse in their characteristics, as met with in Bengal and Siberia, were confessedly produced by such means from one primeval species. In the same way we can easily conceive how, in the primary distribution of mankind, the Turanian, Indo-European, and Hamitic families gradually began to assume their present distinguishing types. Nor would these first physical alterations of the aboriginal type of man require any excessive period of time. Even Mr. Darwin says,[1]—"In some few instances a marked effect has been produced *quickly* on all [the italics are his own], or nearly all, the individuals which have been exposed to some considerable change of climate, food, or other circumstance. This has occurred, and is now occurring, with European men in the United States, with European dogs in India, with horses in the Falkland Islands, with foreign oysters in the Mediterranean, and with maize grown in Europe from tropical seed."

Imagine, then, that soon after the commencement of those migrations by which the great Hamitic family ultimately became distributed over the continent of Africa, and while, as yet, the originally coloured skin of man (though darkened in a measure by hotter suns or bilious climates) remained more or less definitely clear; imagine that a woman of some particular place foremost in the van of that migration had unexpectedly given birth to a boy, who soon became marked by a jet-black skin, and crisp, wool-like hair, and was otherwise possessed of a strong tendency to develop certain peculiarities in the bony structure of his body. In supposing the uprising of some such sudden congenital variety as this, there is really nothing more abnormal or surprising than that which has already been proved to have occurred in the case of the hairy and porcupine families; perhaps scarcely so much so. Assuming, then, that such a fact did happen at some very early period of the world's history after the dispersion from Babel, let us now apply to it the well-established principle of transmission by family inheritance. In perfect consistence with each of the three previously adduced cases of congenital variety, we shall assume that at least certain individual members of this strange family inherited the same peculiarities. The question is, how can we account for any special separation of those particular individuals, by means of which they became involuntarily paired off among themselves, and so perpetuated this new variety? What natural causes are capable of being regarded as sufficiently powerful and inevitable to have forced on this issue, and then brought about the establishment of a Negro race?

To this the following answers were suggested by the writer:—1. Accident, 2. Tribal Quarrelsomeness or Persecution, 3. Disease.

In the discussion that ensued, Mr. A. McArthur, Rev. J. Manners, Mr. Mayow, and the chairman took part. Numerous donations of books to the library were announced at this meeting; the first one held in the society's new premises.

ENTOMOLOGICAL SOCIETY OF LONDON.

JANUARY 3RD.—Mr. H. W. Bates, president, in the chair. Exhibitions of Lepidoptera were made by Mr. Hewitson and Professor Westwood; and of Coleoptera by Professor Westwood, Mr. Pascoe, and Mr. Albert Müller. Mr. Bond mentioned that upwards of 30 specimens of the new locust, *Acridium peregrinum*, had been taken in Cornwall in October last, and two of these were shown.

Mr. Hewitson's exhibition of butterflies was peculiarly interesting, and included no less than 135 new species, besides many rarities, all collected in Ecuador by Mr. Buckley.

The following papers were read:—"On some new British Species of Ephemeridæ," by the Rev. A. E. Eaton. "Descriptions of six new species of Callidryas," by Mr. A. G. Butler. "A Revision of the genus Catasarens," by Mr. F. P. Pascoe. "The Genera of Coleoptera studied chronologically" (part I. 1735-1801), by Mr. G. R. Crotch.

The fifth part of the *Transactions* for 1869 was on the Table.

[1] *Variation of Animals*, &c., vol. ii. p. 290.

ODONTOLOGICAL SOCIETY OF GREAT BRITAIN.

THE Annual General Meeting was held last Monday evening, when the election of officers took place. There was afterwards an interesting discussion upon a paper previously read by Mr. J. R. Mummery, F.L.S., "On the Relations which Dental Caries,—as discovered amongst the Ancient Inhabitants of Britain, and amongst existing Aboriginal Races,—may be supposed to hold to their Food and Social Condition," to which subject we may hereafter refer. The retiring president, Mr. J. H. Barrett, gracefully marked his year of office by announcing his intention of giving two prizes, to be open to all students at the Dental Hospital of the Society, for the best preparations and notes on Dental Caries, illustrating cases actually treated by the competitors.

GLASGOW PHILOSOPHICAL SOCIETY.

A SPECIAL meeting of the members of the Philosophical Society of Glasgow was held on the 22nd ult., in the East Room, Corporation Galleries, when the discussion on the Patent Laws was resumed. Dr. Bryce, president, occupied the chair. The discussion was of considerable length, but had no special scientific interest.

DUMFRIESSHIRE SOCIETY.

A CONVERSAZIONE of natives of Dumfriesshire, resident in Glasgow, was held in the Corporation Galleries, on the 22nd ult., presided over by the Right Hon. George Young, M.P., Lord-Advocate for Scotland, to inaugurate the amalgamation of the two societies in Glasgow connected with that county, viz.—the Nithsdale Society, which has been in existence about three years, and the Dumfriesshire Benevolent, formed about nine months ago by those connected with Annandale, in the prospect of ultimately uniting with the Nithsdale. This event was happily accomplished at the annual meeting of the latter society on 10th December, and the amalgamated society was designated the Glasgow Dumfriesshire Society.

The office-bearers for 1870 are:—Patrons—His Grace the Duke of Buccleuch and Queensberry, the Right Hon. Lord Rollo and Dunning, the Right Hon. George Young, M.P., Lord-Advocate for Scotland. President—James Keyden, Esq. Vice-presidents—Thomas Murray, Esq., James Deas, Esq., C.E., Councillor Chalmers, and James Thomson, Esq. Directors—Messrs. James Blackwood, sen., James Imrie, U. N. Graham, Wm. Thorburn, John Webster, H. D. Rogerson, Alex. B. Inglis, Walter Bell, Walter Paton, Charles Wilson, Thos. Lawrie, Thos. Wright, John Walker, Dr. Charteris, Wm. Hunter, and R. C. Graham. Secretary—Mr. W. J. Thomson, 79, Buchanan-street. Treasurer—Mr. Thos. H. Carmichael, 29, Ingram-street.

Several of the directors and members of the society dined in McLean's Hotel previous to the conversazione, when Mr. Keyden, the president, entertained the Right Hon. George Young, M.P., Robt. Dalgliah, Esq., M.P., J. J. Grieve, Esq., M.P., Sir James Lumsden, and James Grierson, Esq., Dalgourie.

After dinner, the party proceeded to the Corporation Galleries, where a large audience had assembled to enjoy the conversazione.

DERBY NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

THE inaugural meeting of this society, which has lately sprung into existence in Londonderry, was held in the Corporation Hall, on Friday evening, Nov. 19th, when an address was delivered by the president, W. Harte, Esq., C.E., F.R.G.S.I. The audience was very select, and the display of scientific instruments was most interesting. During the evening several pleasing experiments were made by members of the society. The meeting partook of the character of a *conversazione*. The various collections were viewed with much interest. They included the following:—Dredgings in Lough Swilly, geological specimens of Donegal granite, flint implements, &c. (Mr. W. Harte's collection); cinerary urn, found near Grange (Mr. Robert M'Crea); scientific apparatus, &c. (Mr. C. W. Duggan, M.A.); fine collection of native ferns (Dr. Cuthbert); Druidical ornaments (Dr. Forsyth); photometrical apparatus (Mr. M'Nie); electric apparatus, &c. (Professor Leebody); several microscopes of great value, with interesting objects (Mr. Cowie); fine collection of moths (Mr. Harte, Kilderry); hydraulic press (Dr. M'Cay); Rosetta stone, discovered by the French at Rosetta, in Egypt, and which afterwards fell into the hands of the British at Alexandria (Mr. Todd, head-master of Derry Model School). Mr. James M'Corkell and Mr. Thomas Watson were also exhibitors. The proceedings were opened at eight o'clock.

The president then delivered the inaugural address, which was of great length and dealt with the advances recently made in Natural and Physical Science.

MONTREAL NATURAL HISTORY SOCIETY.

The second of the monthly meetings of this association was held on Monday evening, November 29th, Principal Dawson presiding. Col. Wolseley, Q.M.G., Dr. Evans, and Alfred Selwyn, F.G.S., were elected members of the society.

Mr. Billings then read a paper "On the Genus Scolithus and some Allied Fossils," of which the following is an abstract:—The fossils known under the names of *Scolithus* and *Arenicolites* were described as consisting of cylindrical or rod-like bodies, which penetrate the layers of sandstone perpendicularly downwards to a distance varying from a few lines to 2 or 3 ft. There are several varieties, the most common of which has the rods from one-twelfth to one-fourth of an inch in diameter; in another more rare form they have at the surface of the beds a wide trumpet-shaped expansion, 2 or 3 in. across, but taper to a point below, where they are in general more or less curved. Under certain circumstances they can be entirely separated from the rock, and then present the appearance of simple cylindrical or conical rods of sandstone, with no internal structure. All the varieties are more or less distinctly marked by a series of oblique annulations—a character which Mr. Billings thought to be of importance, as it seemed to show that they were all members of one family of organisms.

So long as these fossils were only known by specimens exhibiting no internal structure, it was impossible to decide to which division of the animal or vegetable kingdom they belonged. The Geological Survey had, however, several years ago, ascertained that the Potsdam Formation included a considerable deposit of limestone, in which the same fossil forms were found (first discovered by Mr. Richardson), with the internal structure beautifully preserved. By these it was proved that they were not the casts of worm-burrows, but sponges. The several species, so far as is yet known, were distributed as follows:—

One large species (*Archeocyathus Minganensis*) in the calciferous formation, two in the limestone of the Potsdam, and several in the sandstone. In the next formation below the Potsdam (the Primordial Silurian), Mr. Murray had lately discovered another species in Newfoundland. This latter occurs in a red limestone overlying the Huronian group; and is associated with *Paradoxides* and other primordial fossils. Its internal structure shows it to be a sponge of the same general type as are those of the Potsdam and calciferous, but perhaps of a distinct genus. It is about the size and form of the fossil (*Histioderma Hibernicum*) that has been found in the Cambrian rocks in Ireland. Judging from the form, the oblique annulations and mode of occurrence of the Irish fossil, he was of opinion that it was not an annelide burrow but a sponge. He believed that these ancient sponges, at least many of them, lived in the sand or soft ooze of the ocean's bottom, with their sometimes wide and trumpet-shaped mouths just even with or a little elevated above the surface.

During the discussion that followed, Dr. Dawson said that if Mr. Billings was right it would appear that in the seas of the earlier ages protozoic life had the preponderance. In reply to a question by Mr. Whiteaves, Mr. Billings said that silicious spicula were found in great abundance in association with these sponges. They were generally of an elongated pyriform shape (the "acerate" form of Bowerbank). He supposed they were originally calcareous, but had become silicious during the progress of fossilization.

Dr. Carpenter then made a communication as follows:—"On Different Modes of Computing Sanitary Statistics, with special reference to the opinions lately published by Mr. Andrew A. Watt."

This gave rise to a fierce discussion which, however, had little of interest for any save students of social science.

CALIFORNIA ACADEMY OF SCIENCES.

The California Academy of Sciences held its regular monthly meeting on Monday evening, November 1st.

Mr. Yale presented a specimen of the tusk of a mammoth from Alaska, semi-fossilized; nearly fifty volumes and pamphlets from the Smithsonian Institute were received for the library of the Academy, also four volumes of the American *Conchology*, bound.

Mr. Yale called the attention of the Academy to the November meteoric showers, and stated that on the previous Friday evening he had noticed some.

Dr. Kellogg gave an account of his recent botanical trip, and exhibited a number of plants obtained, among them specimens of *Œnothera Whitneyi*, Whitney's Primrose, discovered by Professor H. A. Bolander, and recently collected on the coast of Humboldt County by him. It was truly a beautiful annual, and worthy memorial of the former president of the society, and might well serve to awaken pleasant reminiscences of the very efficient chief of the late State geological survey. He also presented specimens of his huckleberry-leaf oak—(*Quercus vaccinifolia*, Kellogg), described many years since. The drawing of it, made at the time, was brought before the society again to verify its truthfulness to nature by comparison with specimen, and to correct an error, which by some mistake ascribes the name and description to Sir William Hooker. This had been considered by some as only a dwarfed form (*Q. Chrysolehis*), a tree often from 40 to 50 ft. high, and from 2 to 4 ft. in diameter, with very wide-spreading top, an evergreen, and very valuable tough timber-tree, quite equal to the live-oak of the Atlantic States for ship-building, whereas this is never more than from 2 to 4 ft. high. If the intermediate forms ever run into this, he claimed that they should also have fruit on them, which was never the case. If this is to be considered a mere variety, only dwarfed by locality, soil, or altitude, then by a parity of reasoning the *Garrya Buxifolia* (Gray), which grows with it, should be considered only a dwarfed form of *G. elliptica*. Yet there is no one that would contend for this.

Dr. Kellogg also exhibited specimens of *Brodiæa coccinea* (Gray), and a painting, which was made by him a year previously to the description, and presented before the Academy, together with specimens of the plant, collected by Professor H. A. Bolander. He found, during his recent botanical trip, a purple variety without the usual greenish border. They will be anxiously sought after by florists when better known. He also called the attention of the Academy to his *Chloragalum angustifolium*, figured in the *Proceedings* of April 1, 1861, vol. ii. page 104, and compared the figure and present specimens. He called attention to the impropriety of the name of *nudicaule* as applied to the scarlet larkspur, showing very branching and leafy stems, and also stated that this plant hybernated during the dry season, the roots shrinking and apparently devoid of all life, which was restored by a return of moisture. He made a statement upon the value of a species of Ceonothus, in adding to the cream of milk when the plant was fed to cows, observing that land had been considered more valuable when covered with it. Dr. Cooper made the inquiry if any medicinal qualities had been noticed, and stated that in the Eastern States a species of this plant was used for tea, in the time of the American Revolution.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

Paris, January 3rd.—Under the presidency of M. Bernard and M. Liouville. The time of the meeting was greatly taken up by the election of a vice-president and a correspondent, and by other routine matters. The correspondence of the day was presented by M. Elie de Beaumont.

Father Secchi continues his researches on solar spectra, and checks his observations by experiments on the different gaseous substances, such as nitrogen, hydrogen, &c. He has found that when a gas is inclosed in a capillary tube, it gives different spectra according as its temperature is raised or lowered. M. Dumas pointed out that Captain Trèves had made experiments of a somewhat similar nature to ascertain the different illuminating power of gases in capillary tubes through which electric discharges passed.

M. Dubrunfaut made some remarks on his researches—still in progress—on the spectra of pure and mixed gases.

M. Guyot, of Nancy, gave some of the results of his experiments on rosolic acid as a substance used for tinting vegetable syrups. Although this acid is not poisonous, its employment in the preparation of articles of food and its sale under the name of a vegetable syrup is not the less a fraud. He thinks that as Fuchsine is already used as a tinting material, that rosolic acid will also soon find its way among the confectioners. In order to put people on their guard, he has prepared a number of syrups, and has established the means of readily distinguishing syrups coloured with Fuchsine, Lydine, and the new acid. On account of its ready solubility in water, rosolic acid is likely to be much employed; but, on the other hand, the fact that even the feeblest acid changes its colour will, of course, prevent its being used in acidulated syrups. When added to a neutral syrup it produces a liquid red colour, which, however, changes after a time, owing to the development of organic acids. A syrup which contains both rosolic acid and a free acid has a brownish-yellow tint; ammonia, by the fine red tint it produces, enables us to recognize the rosolic acid, but this tint very rapidly alters, owing to the changes constantly going on in such organic liquids. The following are the principal characters furnished by a syrup containing rosolic acid, which the author prepared artificially:—Free acids or solutions of acid salts change the red tint to brownish yellow; by adding ammonia or other alkali the red tint is restored; an excess of volatile alkali gives a magnificent red hue. Potash has no reaction, and gives no precipitate. Carbonate of soda, in cold solutions, gives no precipitate, and there is no disengagement of carbonic acid; even during ebullition the effect is slight. Hypochlorite of soda has no reaction, but if, after adding it, a few

drops of acid be added, so as to disengage chlorine, the syrup is completely discoloured. This test may also be applied to the syrup which has become brown through addition of alkali, but the reaction is slower. Acetate of lead gives a red precipitate. Nascent hydrogen decolorizes the liquid, but exposure to air restores the colour.

The author lays down the following conclusions:—(1) Chlorine and potash enable us to distinguish between a syrup coloured with Fuchsine and one coloured with rosolic acid. (2) Acids, alkalis, and carbonate of soda, establish marked differences between syrups coloured with Lydine and rosolic acid. The author is engaged in attempting to find a method for the estimation of rosolic acid in coloured syrups.

M. Gaudin addressed what the French call "a reclamation of priority" relative to the manufacture of artificial gems referred to in our last report. In regard to the method described the week before by M. Feil, he said that he had been in the habit for ten years of making precious stones in a similar manner, which consists in placing in the crucible the "emerald of Limoges" and a flux consisting of phosphoric acid, boric acid, fluoride of calcium, and the earthy oxides, lime, magnesia, and baryta. He uses the oxyhydrogen blow-pipe.

The perpetual secretary pointed out that in the collection of the Academy there were some beautiful specimens of platinized glass. These, which are prepared much in the same way as silvered specula, possess immense reflecting power, and yet the quantity of platinum is so small that the glass is perfectly transparent.

A letter was read from Dr. Ollivier, of Batna, on the subject of the earthquake shocks felt at Biskra, in Algeria on the 16th and 19th of November last. The following notes were also read: by M. Zantedeschi on telegraphic cables; by M. Fleury, on the artificial products of the white Agaric; and by M. Lacaze-Duthiers, on his recent researches on the Morphology of Mollusks.

The election of a vice-president then took place. Out of 48 votes M. Coste obtained 25, M. Balard 19, and M. de Quatrefages 1.

In yielding the president's chair to M. Liouville, M. Bernard delivered a brief but touching speech, in which he expressed his sense of the great importance of the post he had held during the year, and congratulated the Academy on the fact that, during his office, none of its members had passed from among the body.

In the place of correspondent in the physics section, the Academy elected Herr Helmholtz. Of 45 votes Helmholtz got 37, Kirchhoff 3, Thomson 2, and MM. Mayer and Angstrom 1 each.

In a memoir presented by Henry St. Claire Deville, the author protested against the expression *nascent state*, so often employed by chemists. He believes that the use of the word is obstructive of the best interests of science.

Lastly, M. Leon Vaillant sent in a paper on the structure of sponges.

ACADEMY OF SCIENCES, VIENNA.

VIENNA, DECEMBER 16TH, 1869.—Sitting of the Mathematical and Natural Sciences Class. Professor Dr. Reuss read a memoir in Italian, sent by Dr. Manzoni, on the Fossil Bryozoa of Italy. The author has gone very fully into the subject, and he describes no less than twenty-one species of Lepralia, and gives four plates illustrative of his observations. Only six of the species are already known: *L. scripta*, *pteropora*, and *tetragona*, Rss., *linearis*, Hassall, *ansata*, Johnst., and *ciliata*, Pall.; the remaining fifteen are quite new. The greater number of the species (twelve) are from the Middle Miocene of Turin; four are from the Middle Pliocene of Castellarquata; and the remaining five are from the Upper Pliocene of Reggio in Calabria.

Professor Dr. Ed. Hering read a very interesting paper on the physiology of the respiratory movements with relation to the influence of the two sets of nerves—the vaso-motor and the true respiratory. He described the results of experiments on animals placed under curara, and whose pneumogastric nerves had been divided. He had employed the kymograph in registering his observations, and he recommends the use of dogs rather than cats in experiments of this kind.

Herren Thiele and Oppolzer both sent in their calculations of the elements of Comet III., 1869.

Lastly, Herr Steindachner gave in the second part of his memoir on the Fishes of Senegal. He describes twenty-eight genera (?) of the following families:—Gobiidæ, Mugilidæ, Gerridæ, Chromidæ, Labyrinthidæ, Pleuronectidæ, and Siluroidæ.

Bees Beneficial to Fruit.—Dr. A. Packard, editor of the *American Naturalist*, replies to a query in regard to the effects produced upon fruit by the agency of honey-bees, that all the evidence given by botanists and zoologists who have specially studied the subject, shows that bees improve the quality and tend to increase the quantity of fruit. They aid in the fertilization of flowers, thus preventing the occurrence of sterile flowers, and, by more thoroughly fertilizing flowers already perfect, render the production of sound and well-developed fruit more sure. Many botanists think if it were not for bees, and other insects, many plants would not bear fruit at all.

NOTES AND MEMORANDA.

Influence of Altitude on Temperature.—Dr. Marcet communicates a paper to the *Bibliothèque Universelle et Revue Suisse*, the results of a series of observations made during an expedition to the Mont Blanc chain of mountains. The *Lancet* thus abstracts it:—"He employed a thermometer so constructed that, whilst the bulb was under the tongue, the height of the mercury could be read off by means of a small mirror attached to the stem. The instrument was carefully graduated to fifths of a degree, but variations not exceeding a tenth were readily visible. The results he obtained were as follows:—1. The temperature of the human body in the state of repose does not ordinarily become less elevated at the summit of high mountains than at the level of the sea. Diminution in atmospheric pressure, therefore, does not appear to have a marked influence on the temperature of the body in a state of repose. 2. The temperature of the body appears progressively to diminish during the act of ascent. The degree of this depression depends almost exclusively on the time that has elapsed since the last meal. As a general rule, rapid mounting, with free transpiration, produces the greatest depression of temperature. 3. The temperature of the body, after undergoing decrease during the ascent, quickly augments when the body is again at rest, or even when the rapidity of the ascent is diminished. 4. The general feeling of indisposition, and in particular the oppression at the heart, that is often experienced at great altitudes, is accompanied with a remarkable depression of temperature of the body generally.

The New Print, the Lichtdruck.—As we some days since called attention to the interesting collection of prints at the Rooms of the Society of Arts, our readers may be interested in knowing that some additional examples of prints produced upon an analogous principle to that described by Mr. Davenport under the title of the "Albert Type," have been added to the collection which is still on exhibition at the society's house. The examples added are called "Lichtdruck," or a new mode of photographic printing, introduced by Messrs. Ohm & Grossman, of Berlin. The process is stated to be "capable of yielding any number of impressions, which can be printed upon unprepared paper with equal effect to copper and lithographic prints in distinctness of colour, outline, delicacy, and indestructibility." The process is simple. A plate for printing can be prepared in a short time upon common glass from a negative. The outlay is not costly, as neither gold nor silver preparations are needed. One penny will cover all the expenses in materials to prepare a common-sized plate, and if an impression be taken in the morning, several hundred Lichtdrucks of the finest finish can be ready by evening. The outlay for the peculiarly-constructed printing-press, and a few minor utensils, is very moderate, and within the reach of any photographer. Any description of paper is adapted for this kind of printing, while for highly-finished prints the inventors use another class of paper, specially prepared by themselves. They are now establishing an academy to teach their new system of Lichtdruck to a select number of pupils at Berlin, and intend to do the same in this country, where Mr. C. F. Jessen, Allemannia-offices, 6, Ship-alley, Bradford, has been appointed agent for the sale and licensing of the process.

A New Type-setting and Distributing Machine.—A new machine has been patented by Mr. Mackie, the proprietor of the *Warrington Guardian*, for composing and distributing types. There are in fact two machines,—one like a small piano, whereby strips of paper are perforated by working keys. In this way the literary matter is prepared for the composing or type-setting machine; the perforations guiding the deposit of the types, which is done by the other machine. "Justification" is done as usual, by hand. The reverse process of distribution is also done by the machine. A well composed and printed page of matter done in this way has been sent us for inspection. Authors may prepare their own perforated slips and send them to the printer in place of "copy." Six perforators and six composers could set up a *Times* page in an hour. The *Engineer* gives an engraving of the larger machine, and speaks highly of its ingenuity and its practical accuracy.

Paper Houses in Reality.—The recent American invention for paper building-material is a success. It has been recently tested in Chicago with the result, we are informed, of fully establishing its utility. It is said that a house 22 ft. long, 16 wide, and 14 high, can be covered on the outside for less than 9 dollars; and a house 36 ft. by 22, and 20 ft. high, for 20 dollars. The building can be done at any season, and can be finished with great speed, and there are said to be numerous other advantages connected with the use of the paper. It differs from ordinary paper in consistency, compactness and solidity. In the manufacture it is subjected to a pressure of hundreds of tons, which squeezes out the liquid matter, leaving a substance of the right thickness. It is said to be proof against damp and gnawing of vermin, and it being an excellent non-conductor of heat, must make a warm dwelling in winter and a cool one in summer. It is used in the place of plastering for inside walls.

SCIENTIFIC DIARY.

WEDNESDAY, January 12th.

Geological Society, 8 p.m. "On the Superficial Deposits of Portions of the Avon and Severn Valleys and adjoining Districts," by T. G. B. Lloyd, Esq., C.E., F.G.S. "On the Geological Position and Geographical Distribution of the Reptilian or Dolomitic Conglomerate of the Bristol Area," by R. Etheridge, Esq., F.G.S.
Graphic Society, 8 p.m.
Royal Microscopical Society, 8 p.m. "On the Calcarious Spicula of the *Gorgoniada*," by W. S. Kent, F.Z.S. "On an Undescribed Stage of Development of *Tetrarhynchus corollatus*," by A. Sanders, M.R.C.S., &c. "On a new Method of Measuring Spectra Bands," by John Browning, F.R.A.S.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.
Belfast Natural History Society, and the Belfast Naturalists' Field Club, joint meeting, 8 p.m. "A Description of an Ancient Stone Coffin, found at Movilla, County Down," by Mr. W. H. Patterson. Mr. William Gray will exhibit a collection of Continental and American Flint Implements, &c., and compare them with the Flint Implements found in the North of Ireland.

THURSDAY, 13th.

Royal Society, 8.30 p.m. "On the Mineral Constituents of Meteorites," by N. S. Maskelyne. "On Fluoride of Silver," by G. Gore, F.R.S. "Approximate Determinations of the Heating Powers of Arcturus and Lyræ," by E. J. Stone, F.R.S.
London Institution, 7.30 p.m.
Society of Antiquaries, 8.30 p.m.
Zoological Society, 8.30 p.m. Descriptions of a new genus and of eighteen new species of Land and Marine Shells, by Mr. Henry Adams. "On the genus Pelargopsis of the family Alcedinidæ," by Mr. R. B. Sharpe. Description of a new Fish from the vicinity of Aden, by Lieut.-Colonel R. L. Playfair.
Royal Society Club, 6 p.m.
Mathematical Society, 8 p.m. "Equations of Centres and Foci of certain Involutions," by Mr. J. J. Walker.
Bradford Philosophical Society, 8.15 p.m. Second Lecture "On Sound," by W. F. Barrett, Esq., F.C.S.
Brighton and Sussex Natural History Society, 8 p.m. "On Volcanic Theories," by Mr. J. Mayall, M.R.I.

FRIDAY, 14th.

Clinical Society, 8.30 p.m. Annual Meeting. "Case of Cancer involving the Left Half of the Soft Palate," by Mr. Langton. "Case of Facial Carbuncle," by Mr. Thomas Smith.
Royal Astronomical Society, 8 p.m.
Quekett Microscopical Club, 8 p.m.
Old Change Microscopical Society. Professor Rymer Jones's Lectures "On Comparative Anatomy."

MONDAY, 17th.

Victoria Institute, 8 p.m. "On the Testimony of Philosophy to Christianity as a Moral and Spiritual Revelation," by Rev. C. A. Row, M.A.
Society of British Architects, 8 p.m.
Medical Society, 8 p.m.
London Institution, 8 p.m.
Torquay Natural History Society, noon. "On a Scamper through Cornwall," by Dr. C. Paget Blake.
Bradford Philosophical Society, 8.15 p.m. Conversazione in St. George's Hall, given by the president, Mr. W. H. Ripley.

TUESDAY, 18th.

Statistical Society, 8 p.m. "On the Statistics of Joint Stock Companies from 1814 to the present time, and of Companies with Limited and Unlimited Liability, formed since the year 1856," by Prof. Levi.
Institution of Civil Engineers, 8 p.m.
Pathological Society, 8 p.m.
Anthropological Society, 4 p.m. Anniversary.
Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.
Leeds Philosophical Society. "The Poetry of Robert Browning," by the Rev. T. H. McCheane, M.A.

WEDNESDAY, 19th.

Hunterian Society, 7.30 p.m. Council Meeting. "Cases of Injury to Skull and Brain," by Mr. Corner. "On a Case of Popliteal Aneurism," by Mr. Brownfield.
Epidemiological Society, 8 p.m. Council Meeting. "On Cholera in Senegambia," by Staff-Surgeon Gunn, communicated by the Director-General, A.M.D.
Royal Society of Literature, 8.30 p.m.
Meteorological Society, 6 p.m. Council Meeting. 7 p.m., Ordinary Meeting.
Society of Arts, 8 p.m. "On the Coral and Pearl Fisheries," by P. L. Simmonds, Esq., F.S.S.

SIR W. THOMSON *v.* GEOLOGY.—"P. W. S. M."—Your private note has just reached us. If you want to have the letter appear in next week's issue, you should let us have the MS. earlier than you propose. We usually have such a quantity of matter standing over, that we are compelled to have our copy in as early as possible if the matter is intended to appear at a short notice. Thanks for your good wishes. An eminent geologist has written to us privately, expressing his satisfaction in reading your letter.

DELPINO AND DARWIN.—Mr. Darwin's wishes shall be complied with. A proof shall be sent forthwith to Mr. Darwin's address. We are much obliged.

GALVANIC BATTERIES.—"L. T." should consult Noad's *Student's Text-book of Electricity*: it is the best work in English that we are acquainted with,—at least, so far as "L. T.'s" wants are concerned.

THE EARTH FLAT.—If "J. H." will kindly define what he means by *level*, we shall be happy to give some reply to his somewhat unintelligible question. We fancy "J. H.'s" ideas are rather confused.

PATENT LAWS.—"W. L. W."—The subject is hardly of a nature to justify our publishing so long a report. You will see that we have referred to the discussion in our "Week." We quite concur in the course taken.

POLLEN GRAINS.—"H. C."—A recent paper in the *Jahrbuch für Botanik*.

NICKEL ALLOYS.—"G. M."—It is curious that the Bactrian coins, some of the Chinese, and one of the recent English West Indian coins all contain nickel. Nevertheless nickel has not been long known to European metallurgists.

SPORES ON TOBACCO.—"M. M. C."—Place them under the microscope. We doubt if you put it in sugar whether the spores would germinate.

OYSTER'S STOMACH.—"Micro."—Yes. It would be worth while to examine (as has been recently suggested by an able geologist) the stomachs of some of the mollusks taken up in the Atlantic expedition, with a view to discovering whether diatoms are not abundant therein. This would clear up Mr. Jeffreys' doubts.

PRIMARY SOURCE OF CARBON.—"P. L. S."—The statement—if it means anything—is nonsense. The writer does not know anything about the subject.

TERRACES IN NORWAY.—"M. H."—Thanks for the MS. As you have not given us the professor's exact address, perhaps the proof had better be sent to you. There is no need to send the copy. This, however, as you please. We should wish to have the first part appear at once.

PHOTOMETER.—"Gaslight" should consult the *Journal of Gaslighting*. Professor Anderson, of Queen's College, Birmingham, has done some good work in this direction.

GLASS MIRRORS.—"H. C. T."—See our report of the French Academy in this number.

PHOTOGRAPHS OF THE MOON.—"B. M."—Mr. De la Rue's beautiful photos may be seen in one of the corridors of the Royal Society, where they are suspended in frame.

BUBBLES FOR PHYSICAL EXPERIMENTS.—"P. D. E."—1. Consult Plateau's papers. 2. Oleate of soda.

THE LECLANCHÉ (?) BATTERY.—"Physicist."—No; we have not yet seen it. We have directed our reporter to inquire. We fancy the material of the cell, and not of the elements, is the chief peculiarity.

HYGROMETER.—"V. C."—If you used Richardson's anæsthetic spray-bellows, you could perform the experiment very successfully.

INDUCTION COIL AND VACUUM EXPERIMENTS.—"An Amateur" cannot do better than purchase the excellent and wonderfully cheap set of instruments just made by Browning, of the Minories.

FISH SCALES.—"Zoo."—Williamson's Memoirs.

OUR NEW VOLUME.

With a view to meet the extending requirements of this Journal, we have permanently enlarged SCIENTIFIC OPINION, *and have introduced various improvements suggested by the experience gained during the production of the first two Volumes. May we ask Subscribers to remind those of their Scientific friends who are not already in the habit of regularly purchasing* SCIENTIFIC OPINION, *that the commencement of the present Volume presents a very favourable opportunity to intending Subscribers.*

WEDNESDAY, JANUARY 19, 1870.

WORKING MEN'S COLLEGES.

OF late years it has become popular to pet the working man, and we trust the working man will not have been spoilt by the ordeal. Among the many new institutions specially created for his benefit are what are called the Working Men's Colleges; and it is to these that we wish to direct the attention of our readers. A series of schools and museums has been projected for the improvement of the working man's mind; and though a few only of these now exist, there is no doubt that their number will quickly increase. But though numerically they are not of much significance, the Working Men's Colleges are just now, by the public consideration they are receiving, growing into an importance they did not previously possess. From this will flow, in due course, more of the patronage and support of the wealthy, and it is high time that some thought should be given to the question of the plans and aims of these embryo schools. In carrying out successfully any scheme for the improvement of the people generally, it is essential to have a uniform plan, and to see that that idea of unity is efficiently executed. Is there such a plan in the minds of those who are fostering the workmen's colleges? Is not the whole thing vagueness and chaos? Is it not true that the workers in one town are operating quite independently of those elsewhere, and that the ideas upon which the scheme of the institution is laid are such as have sprung up spontaneously in the heads of those immediately concerned with each individual college? So far as we have been enabled to gather, all these questions are at present to be answered in the affirmative. We could wish it were otherwise, and we should be glad to learn from some of our correspondents that the case is not so bad as we state it. But from all that we have learned, what we allege is true—viz., that the workmen's colleges and similar schools, which are now opening into existence in various parts of the country, are not the outcome of any common plan, but are merely the consequence of ill-directed undisciplined efforts to benefit the artisan.

This is a very great evil, which it will be well to eradicate as early as possible; and we trust, therefore, that our "working men's" friends will receive in good part, as meant in simple kindness, a few observations which we take the liberty of making in reference to what we think ought to be done. It is an idle distinction, that of "working man." We are all—at least, those of us who deserve the name of men—working from our cradles to our graves—ever acquiring ideas, and reasoning from them and elaborating schemes for our improvement. What is good, then, for one working student must be so for another; and it does not seem to us that the Working Men's Colleges, as they present themselves now, are likely to achieve much for the mental improvement of the working man.

In one locality the College is a sort of newsroom, in another a mechanics' institute, in a third a lecture-hall, where itinerant orators treat their audiences to dilute science and small wit, and so on. Now, not only is there an absence of uniformity here, but there is an absence of those very conditions which are calculated to benefit the working man. The supporters of the College movement should draw up a plan applicable to all the colleges, adapted to the wants of artisans, and capable of being worked at moderate expenditure. Unless this is done, and done quickly, there is danger that a most excellent project may be defeated in its aim, through misadventure and mistake. The existing colleges are, in our opinion, far from likely to effect much good, and we trust that working men will pardon this very unequivocal expression of opinion on our part.

What the "working man" requires—if our estimate of him be correct—is the means of making himself acquainted with the teaching of modern Science and the application of modern Art; we assume for the moment that mere literary demands are trivial. And this is a general statement. But is the want met by the present plan? Surely our readers will admit that it is not. The new colleges, on however humble a scale they may be framed, should provide the working man with workshops, laboratories, libraries, and museums. They should give him the opportunity of teaching himself, and they should further have a staff, however limited, of tutors. Lecturers should be religiously eschewed. The lecture system is known to be a vicious one, and it occupies much time, and requires men specially gifted in order to be of any use at all. The tutorial method is, to those who know anything of the two, the better, and should be the one accepted by the working man. It demands of the teacher little more than a knowledge of his subject, and an earnest desire to instruct; it does not overload the brains of the pupils, and it gives all—the quick and the slow—equal or nearly equal chances of learning. Professional lecturers should be avoided, save when men of special eminence are asked to give a discourse on some special branch to which they have devoted particular study. The libraries should consist at first of text-books exclusively, and subsequently works of reference should be added. The museums should contain simple typical collections, and should be as devoid as possible of the mummies and savage implements which unhappily cumber the space of so many provincial collections. The laboratories should be roomy, and provided with the chief standard chemical and physical apparatus, curiosities being rejected for instruments of sterling value and real usefulness. It is wonderful how much might be done in the above-mentioned directions for from two to three hundred pounds, provided the money was judiciously laid out by some experienced scientific man. On the other hand it is equally remarkable how much money might be expended in mere rubbish by a well-intentioned but unskilful committee.

A thoroughly practical scheme thus uniformly put in practice is what is desirable. Anything short of what we have sketched must end in signal failure, and we hope that our fellow-workmen, mindful of their own interests, and of the welfare of England, will make a determined move to take the plan out of the dilettanti hands in which it now too generally rests, and will, in their own calm sensible and determined way, and with good advice, shape the future of these colleges.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

THE course of Arboriculture at the Conservatoire des Arts et Métiers was commenced on Thursday last by M. du Breuil, and will be continued twice a week at one o'clock. The following subjects will be dealt with:—General vegetable anatomy and physiology, natural agents in vegetation, and the industrial and horticultural uses of trees and shrubs.

AT the election in the French Academy on the 10th, the place of Correspondent in Physics, vacant by the death of M. Matteucci, was given to Dr. Mayer. Strange to say, Angström obtained only one vote and Kirchhoff five, against forty for Mayer.

THE *Revue Celtique*, a journal to be devoted to Celtic philology, and to be written by both Continental and British students of Celtic, will make its first appearance at the end of

this month. The subscription, without postage, will be 20f. a year.

Vesuvius is in a state of partial eruption, belching out smoke and cinders.

We are sorry to see that the annual subscription to the serial, *Matériaux pour l'Histoire primitive et naturelle de l'Homme*, has been increased. It was originally 10f. a year in Paris, and is now increased to 12f.; and the foreign subscription is raised from 12f. to 15f. per annum.

The well-known treatise on *Conic Sections*, by Dr. Salmon, of Trinity College, Dublin, has been translated into French under the title of *Traité de Géométrie Analytique*, by MM. Resal and Vaucheret, and is sold at 10f.

The first *soirée* of the year takes place to-night at the London Institution, at half-past six. After the *soirée*, at eight o'clock, a lecture will be delivered by the Rev. H. B. Tristram, on the recent explorations in Jerusalem.

The *Journal of the Statistical Society* for January is just out, and contains several communications and abstracts of importance.

At its last committee meeting the Quekett Club resolved to rescind its recent determination to terminate the publication of its *Journal*. It is thought that some effort will be made by a few more interested members of the Society to go on with the periodical in question, but it is believed that the voice of the general body will be distinctly opposed to a measure which, without advancing the interests of the Society, considerably exhausts its exchequer.

The *Athenæum* is our authority for stating that Dr. Marschall, assistant curator of the Royal Museum of the Netherlands, at Leyden, is studying the Spongidæ, with a view to publishing a work upon the class. Dr. Marschall is an exact and laborious worker, and his views upon the classification of sponges will probably advance the subject considerably.

Captain Burton having published his Tales of "Devilry," is about to go in search of "The Mount of God," not to Sinai, but east of the Gulf of Akaba.

The American sensational paragraph-writers have been making capital of the recent discovery of the nature of the solar prominences. In a Michigan journal there appears a paragraph declaring that a column of magnetic light is shooting out from the sun at a prodigious speed—that it already reaches halfway to the earth, and that, in all probability, by another summer we shall have celestial and atmospheric phenomena beside which our rudest winter winds will seem like a "June morning in Paradise." In fine, that when this big tongue of fire touches the earth it will likely lap up our globe at one mouthful.

A week or two since we called attention to an absurd letter in the *Athenæum* (a letter which our contemporary, mindful of its old reputation, should never have published), to the effect that the limestone of Cork Harbour contained reptile vertebræ. We are glad to find that Mr. W. H. Baily, the well-known palæontologist of the Dublin College of Science, has written to show that Mr. Lake's reptile is nothing more than a good-sized orthoceratite.

Those who care to inspect the ingenious mechanism of chiming clocks should pay a visit to the newly consecrated church of St. John, at Croydon, where a most wonderful clock, devised by Messrs. Gillett & Bland, is now to be seen. Several new contrivances, especially in relation to the way in which the hammers are lifted, have been introduced. They are not raised by the barrel, as is the case under the old system, but by means of revolving cams, fixed on a long shaft, driven by the main wheel at one end of the driving-barrel, to which the weights giving the motive power are attached. An ingenious arrangement of mechanism regulates the velocity of these cams, and also the barrel upon which the tunes are pricked, which revolves once in about seventy-five seconds. The pins on the barrel are about one-sixteenth of an inch square. Over this barrel are several keys working on a shaft. They have catches at their upper end, and projecting pieces at the bottom, which on giving them a slight pull release the ends of the hammer levers, and the hammers fall on the bells. The two actions of letting off and raising the hammers being simultaneous, the blow on the bells is scarcely felt on the musical barrel, and all dragging and unevenness of action is avoided, which must be so detrimental in machines made on the old system.

In a very interesting letter to the *Times* the Rev. B. G. Johns gives several very definite and urgent reasons for concluding that the Roman letter is the most useful in the education of the blind. Among other advantages he cites the fact that if symbols be used instead of letters, then the blind can receive no help in their labours from their fellows, who are unfamiliar with the special "code" employed.

It is suggested as a means of preventing railway collision that some mechanical contrivance better than the ordinary "brake" should be adopted. It is recommended to adopt a system in use on some of the Continental railways. Some 1,500 engines of the Paris, Lyons, and Mediterranean Company have already been fitted with the necessary apparatus, and more than half of all the engines in France are fitted with this simple and inexpensive apparatus, which makes the power of the locomotive a retarding as well as a moving force. The system is known as "Le Chatellier's counter-pressure steam-brake," and is an unpatented gift to the public. The effect of using the counter-pressure steam-brake may be roughly judged of by the fact that each pair of driving-wheels of the locomotive worked under counter-pressure gives a stopping resistance equivalent to the full effect of a loaded brake-van. Thus:—An express engine with four wheels coupled equals two brake-vans; a goods engine with six wheels coupled equals three brake-vans; and a goods engine with eight wheels coupled equals four brake vans; a rule or result which has been established by experience on the Paris, Lyons, and Mediterranean Railway. But the simple mechanical effect does not represent the efficiency of this system for preventing collisions. The power is in the hands of the driver of the locomotive himself. He has not to depend on his whistle to call the attention of the brakeman for power to reduce his speed. He has not, on account of possible inconvenience from whistling without good cause, to hesitate. Le Chatellier's apparatus may be put into action without a moment's hesitation, on the slightest alarm, without any prejudicial result to the mechanism of the locomotive, without any jerk to the train, and without any distracting whistle. The counter-pressure steam acts instantaneously, three or four seconds being, in fact, sufficient for the whole manipulation from full forward gear to full backward gear.

An eclipse of the moon, partially visible at Greenwich, took place on Monday.

Cambridge students cannot complain that they have no means of obtaining a knowledge of anatomy. The Professor of Anatomy gives notice that the course of lectures on practical anatomy, which recommenced on Monday last, will be continued, at 1 p.m. daily, till January 26; after that, they will be given on Mondays, Wednesdays, and Fridays, at 7 p.m. The course on anatomy and physiology will be continued in the new Museums on Thursday, January 27, at 1 p.m., and on Tuesdays, Thursdays, and Saturdays at the same hour. This course is intended for students of natural science and for students preparing for the special examination for B.A., as well as for medical students. Gentlemen who do not require certificates are at liberty to attend without fee. Microscopical demonstrations will be given in the old Anatomical Museum on alternate Mondays, at 6 p.m., commencing February 17. With

the assistance of Mr. Garrod, of St. John's College, demonstrations of physiological chemistry will be given in the old Anatomical Schools on Saturdays, at noon, commencing February 5. Gentlemen attending the physiological lectures are at liberty to attend the microscopical demonstrations and those of physiological chemistry.

Further intelligence of Dr. Livingstone reaches us from Bombay, where a letter dated May 30, 1869, but containing no address, has been recently received. Dr. Livingstone complains of the great difficulty in getting faithful messengers to carry news and supplies between himself and the coast. The Arabs of Unyanlembe, amongst whom he was, hate the English, and being actively engaged in the slave trade, they dread exposure through his letters, and will therefore neither carry letters for him themselves, nor will they, if they can help it, allow others to do so. With regard to the work still to be done, Dr. Livingstone says that he has to establish a connection between the Nile of Speke and Baker, and the sources which he himself discovered some 500 or 700 miles to the south of the point to which they penetrated. In order to ascertain whether the outflow of one lake, hitherto unvisited, belongs to the Nile or to the Congo, he will have to pass through the country of a people called Manyema, who are cannibals.

The Darien Canal project is reviving. The United States steamer *Nipsic*, attached to the South Atlantic squadron, is under orders to proceed to the Isthmus of Darien to make surveys and explorations, with a view to determine the best situation for an inter-oceanic canal. A similar survey on the Pacific shore of the Isthmus will be made at a future day. It is asserted that President Grant will recommend the early construction of this Darien ship-canal.

Venus has been distinctly seen in daylight during the last week or ten days. The greatest brilliancy was attained yesterday.

To those who love to go into the question of the reconciliation between the first chapter of Genesis (literal) and the geological record of creation, a letter by Professor Macgregor to the Edinburgh *Daily Review* will be read with interest. *Apropos* of the six days' question, which has been raised afresh by the Rev. Mr. Gilfillan, the Professor has the following reply:—"Regarding the duration of the days, the Confession says nothing. It is probable that most of the Westminster divines believed that the days were 'natural' or 'literal' days, of 24 hours each. It is possible that some of them may have, like Thomas Burnet, regarded the days as creative epochs of great and indefinite extent. It is certain that whatever may have been their personal opinions regarding the duration of the days, they have not introduced any opinion regarding that duration into the Confession of their faith. Accordingly, the recent assailants of the Confession, in their polemic against its statement about 'the space of six days,' find it necessary to perpetrate an interpolation. Where the Confession says simply 'six days,' they, professing to reproduce its utterances, interlope some such words as 'natural' or 'literal,' making it to say 'six natural days' or 'six literal days.' The interpolation may be necessary in order to make plain their view of the import of the Confession. But the necessity of interpolation shows that their view is mistaken. If the Confession had dogmatized about the duration of the days, it would have been the easiest thing in the world to prove this, by producing the dogma in terms of the Confession—without interpolation of terms by the assailant."

What is to become of the main-drainage works. It seems that the Thames Conservancy is determined to apply to Parliament to prevent the Metropolitan Board of Works from discharging sewage into the Thames without previously rendering it innocuous. Is the latter conceivable?

The *Observer* having circulated some ridiculous *canard* about a pupil of Liebig's who has "discovered certain ethers which, when poured upon some chemical compounds, produce instantaneously precious stones of all kinds" (!), the *Pall Mall Gazette*, with exceedingly bad taste, associates this fictitious allegation with its account of Mr. Gamgee's really clever and useful method of preserving meat. When will newspaper writers learn even the elementary A B C of science?

We learn from accounts in the Scotch papers that gold has been found near the famous Falls of Foyers. Not only in several washings from the river was the precious metal found, but in a basin of alluvial drift found below a range of trap rock a "colour" was detected. The Messrs. Ferguson recently examined part of the watershed of the Nairn, and, in the course of two hours, report having found two pennyweights. This gold is pronounced superior in quality to the Sutherlandshire metal; while the specimens of washings from Foyers closely resemble Californian gold, and promise to be rich in quality.

The Aberdeen University Lord Rectorship has been decided. The Duke of Richmond, who, as Chancellor of the University of Aberdeen, had the casting vote in the voting of the "nations" for the Lord Rectorship, has decided in favour of Sir William Stirling Maxwell, as against Mr. Grant Duff, M.P.

The Sunday lecture movement has recommenced. The Sunday Lecture Society has drawn up a programme of a series of thirteen lectures, which will be given at St. George's Hall, Langham-place. The first was given on Sunday last by Dr. W. B. Carpenter, F.R.S., on "The Deep Sea: its Physical Conditions and its Animal Life;" Dr. Carpenter will also lecture on Sunday next;—Mr. J. Beavington Atkinson, on "Raffaelle and Michelangelo;"—Dr. T. Spencer Cobbold, F.R.S., on "Fossils and their Teaching;"—Mr. R. H. Horne (author of *Orion*), on "The Old English Mystery, Miracle, and Morality Plays;"—and Mr. J. M. Capes, M.A., on "The Fine Arts in their Relation to Natural Beauty and Moral and Intellectual Perfection," will follow. Lectures are promised also by Professor Huxley, Mr. Norman Lockyer, Dr. Hodgson, Mr. A. H. Green, M.A.; Rev. Professor Lewis Campbell, M.A.; Rev. Allen D. Graham, M.A.; and the Hon. Auberon Herbert, M.A.

It is curious that, like everything else concerning Ireland, much of what we are told concerning the mineral resources of that country is inaccurate. Mr. G. H. Kinahan, one of the most active members of the Irish Geological Survey, now points out that an article on this subject in the current number of the *Quarterly Journal of Science* is full of mistakes and quite untrustworthy.

According to the *Lancet* the Spanish are availing themselves extensively of the system of free teaching inaugurated by the new Government. At the present moment there are as many as fifteen free universities at full work in Spain. Not only such large cities as Barcelona, Madrid, Seville, Salamanca, &c., have their free universities, but many other localities of less importance, such as Caceres, Onate, Vittoria, Avila, Burgos, &c. There is even a free university at Teneriffe, in the Canaries. A free school of Pharmacy is also about to be opened at Cadiz.

Mr. Mongredien's work on Trees and Shrubs will very shortly be published.

"It never rains but it pours," says the old proverb. Owen's College has been very lucky lately, and now we hear that Dr. Lee, the late Bishop of Manchester, has bequeathed his extensive library to the trustees of Owen's College. The library is said to be unusually rich in valuable editions of the Holy Scriptures.

When Mr. Ernest Hart exhumed the *British Medical Journal* from the slough of commonplaces in which it had for years been submerged, he started the very excellent idea of giving a series of reports on various sanitary matters of importance to the public. His successor to the Editorship is not less

active. In the current number of the *Journal* we find an admirably drawn-up report on the chemical and general qualities of the "Old" and "Mild" ales sold in different parts of London. Oyer! ye disciples of John Barleycorn.

What muscles are thrown into action in giving the different expressions to the countenance? This has been answered by Bell and many others. A curious mode of demonstrating the effect of each individual muscle has been hit upon by Dr. Duchenne, of Boulogne, the great electro-therapeutist. He has adopted the plan of "Faradizing" the different muscles, and then photographing the face while the muscle is in contraction. His description of his results is reviewed in the current number of the American *Psychological Journal*, and several capital photographs from Duchenne's negatives accompany the review.

There is now little doubt that a Zoological Society will be established at Liverpool.

It is very unfortunate that, owing to the extinction of the Cavendish Society, the translation of Gmelin's *Chemistry* was never completed. The last volume, which was to contain the index, has not yet appeared, nor indeed is it likely to, we fear. Under these circumstances, we quite concur in the following remarks in a letter to the *Chemical News* of Saturday:—"In the absence of the index volume, this magnificent work is almost useless to chemists for reference. Two or three years having elapsed without any progress towards our attaining this index being apparent, may I inquire whether Messrs. Harrison have any copyright in this work, and if not, suggest that it would, probably, be worth the while of some other publisher to set vigorously about producing the index to Gmelin."

Mr. T. Nichols has published a useful Handy-book for visitors to the British Museum.

THE DIFFERENT FORMS OF LIGHTS USED IN BRITISH LIGHTHOUSES.

In Two Parts.—Part I.

WHAT were the lights of olden times? Beacons, simply: large fires—primarily wood, latterly coal. The last coal-beacon used was at St. Bees, and was extinguished so lately as 1822. They were efficient in their way. The old coal-beacon at Spurn Point, the mouth of the Humber, could be seen for thirty miles.

When the Eddystone was first lighted, it was with a chandelier of twenty-four wax candles, five of which weighed 2 lb. At that time the great Cordovan lighthouse was lighted with billets of wood, and oil-lamps with reflectors were just coming into use.

The lights under the control of the Trinity Board vary from a simple gas or oil lamp, probably kept up by a local board, and costing a mere trifle, to the larger Argand burners used singly or in groups, sometimes as many as thirty each, with its separate reflector, till we come to the first-class dioptric lights of the largest class, with their elaborate and expensive arrangement of lenses, costing about £2,000; the expense of erection, maintenance, and attendance proportionally increasing.

The great object in lighting arrangements is, of course, to obtain the maximum of light with a minimum of cost, and to insure the direction of the light to the proper point. Some attempts in this direction were made with the old beacons, but we have no record of anything satisfactory or successful. But with the Argand and similar lights, and our recent scientific researches, immense improvements have been made in this direction, and by the judicious application of the proper means, the scope and direction of the lights can be managed to a nicety; and not only is the efficiency of the light increased, but, by the careful direction of all, as they may be called, stray rays in a proper direction, a distinct economy is the result.

The invention of the Argand lamp, in 1780, was the first great step to the improvements above alluded to.

As is well known, in principle it consists of a cylindrical wick open in the centre, and covered externally by a glass chimney. To the present day its modifications are the principal instrument in our lighthouse system. The later discoveries are the Drummond light, produced by jets of oxygen and hydrogen upon a ball or cylinder of lime, and the magneto-electric light, produced by the direction of a powerful magnetic current through two opposing points or pencils of charcoal; they have both been employed in first-class lighthouses to a limited extent. Gas-lighting has also been tried; but at the present moment nine-tenths at least of the light of our lighthouses comes from the Argand burner with colza-oil. It is employed in various ways with many scientific applications, which grow day by day in perfection and complexity. The systems of lighting all houses of the first-class may be divided into two—the catoptric and the dioptric; the principle of the first being reflection, that of the second refraction.

On the catoptric plan a number of lights are usually employed, ordinary Argands, of about 1 in. diameter, each with its separate silvered parabolic reflector. The power of the light becomes a question of simple multiplication; a second-class catoptric has eighteen burners, a first-class one thirty.

On the dioptric principle one central light is used—either an Argand of great size with four concentric wicks, a Drummond, or a magnetic light; and the direction and concentration of the rays are controlled by a scientific arrangement of prisms of glass disposed all round the light generally in a circular form. The angles and proportions form an element of the nicest mathematical calculation, and we may fairly say that upon this head there is yet much to learn, and that it is in this direction that future improvements will develop themselves. Messrs. Chance, of Birmingham, have been distinguished for the great attention they have paid to the manufacture, and the success that has attended their efforts. The cost of these various lights varies in proportion—the new light recently erected at the Smalls costing £1,600 (dioptric), the catoptric apparatus being much cheaper; the larger outlay, however, repays itself in course of time by the economy of working, an extensive average calculation, showing that the annual outlay of a first-class catoptric is about £340, while a first-class dioptric costs only about £265; the principal item of difference being the oil, of which the large central lamp consumes less than the thirty small Argand burners. And here we may notice the great advance that has been made in the construction of the lanterns that inclose the lights as well as of the lights themselves.

When the dioptric light was first introduced at the Eddystone, the upright divisions of the glass were about 5 in. wide; the following was the result:—From a Government vessel in Plymouth harbour a letter was written to the authorities in London, stating that at a day and hour named, the Eddystone light was *out*. An immediate inquiry was ordered, and it was ascertained beyond a doubt that such had not been the case. It was suggested that the vessel might have anchored in the line of shadow caused by one of the bars. A yacht was sent round to make accurate observations as to whether this effect really was produced, and a cruise round the light at some distance convinced everybody that this was what had really taken place.

To obviate the difficulty, a lantern was designed by Mr. Stevenson, the engineer to the Northern Commissioners, composed entirely of triangles, without any upright bars, each pane, as it were, forming a three-cornered facet of flat glass, and this was a great improvement; the drawback was that a large proportion of light was lost by reflection: it was almost impossible to fix a glass in the facets perfectly true, and conse-

quently the light was reflected in quarters where it became useless, the loss being estimated at about 10 per cent.

Mr. Douglass, the engineer to the Trinity Board, then invented the present lantern, which is a perfect cylinder, divided into lozenge-shaped panes by a bar following a true helical coil, so that at every point of contact the side of the bar is at a true tangent with the circumference of the cylinder, and the maximum of strength is gained with the minimum of obscuration.

The bars are of rolled steel, $4\frac{1}{2}$ in. by $\frac{5}{16}$ in., with a bead of gun-metal, L shaped, and $\frac{1}{2}$ in. thick to secure the glass; the outer edge is finished with the ordinary astragal and hollow, and the inner edge, the gun-metal, is rounded; the bars are all rolled in halves, and each lozenge-shaped pane is complete in itself; they are built up, as it were, and fastened together with rivets, the right and left hand lozenges meeting at any given point, thus forming a complete stay and connection with the panes above and below. The glass is bent exactly circular to the lines of the lantern, consequently both lozenge frames and glass are everywhere interchangeable. In case of any strain occurring to the lantern and breaking the glass, a fresh pane can easily be substituted by the keeper without a skilled workman. To show the perfection of the construction, however, we may say that though fourteen lanterns have already been constructed upon this principle, there has not yet been one broken pane of glass. We may add that this construction of lantern was most carefully investigated by the late Professor Faraday before its final adoption, and that it reduces the loss of 10 per cent. of light upon the old system to 3 per cent.; while the bent glass has been proved by experiment to be 68 per cent. stronger than the flat. There are six different recognized sizes of dioptric lights, and as many or more of catoptric; and besides the distinction of size, different lights are exhibited, in different ways and in different colours, to enable mariners to distinguish one light from another.

They may be distinguished as fixed, revolving, flashing, intermittent; the times of different lights varying in their intermittance from five seconds, with many variations, up to four minutes. Many lights, harbour lights principally, are coloured blue, red, or green. It will be seen what infinite varieties of combination may be introduced by these various means; the intelligence so conveyed may fairly be called the language of the lighthouses.—*The Builder.*

ON CHEMICAL EQUILIBRIUM.—INFLUENCE OF PRESSURE ON THE REACTION BETWEEN CARBON AND HYDROGEN.

BY M. BERTHELOT.

THE play of conflicting chemical reactions, and the equilibrium established between them, are simplest, theoretically, when such reactions are developed in homogeneous systems, entirely gaseous, or even entirely liquid, and capable of remaining homogeneous during the whole duration of the experiment.

Under these conditions, all the reacting particles remain in complete and unceasing contact, no secondary complication occurring to withdraw one of them from the field of chemical action. Not so in the case of reactions which take place between a gas, or liquid, and a solid; under these circumstances, reaction occurs only at the points of contact, which undergo the influence of numerous physical conditions, accessory and foreign to true chemical action, which they tend to complicate.

Meanwhile, the principal masses, separated from each other by the gaseous state of the one, opposed to the solubility of the other, remain neutral and inactive.

The homogeneous system is, therefore, in my opinion, the best adapted for the theoretical study of affinities—that is, the study of those forces which determine chemical combinations and decompositions.

From this point, my researches commenced upon the study of affinities, examined in ethereal reactions, which present a type of slow progressive action and of action limited by inverse reaction.

Ethereal reactions may be examined by an entirely gaseous system, or by one wholly liquid and permanently homogeneous. Their characteristic equilibrium varies continually with the relative proportions of reacting bodies, contrary to what occurs in reactions of acids on bases. It also varies continually in gaseous systems, according to the pressure—that is, according to the condensation of matter, but it is independent of temperature between the limits of zero and 280°.

The fundamental condition of homogeneity is, perhaps, fulfilled by reactions effected on the gaseous system under lively combustion, such as were studied with such advantage by M. Bunsen. Here the reactions are abrupt, and occur almost instantaneously: the equilibrium which generally arises between contrary actions no longer obeys the laws of continuity, but varies after the manner of chemical equivalents. When the proportions of reacting bodies change progressively—as, for instance, in systems formed of hydrogen, oxide of carbon, and oxygen, on the contrary, the relative proportions of products formed vary by abrupt leaps.

The relation between the entire volume of a mixture of combustible gas and that of the portion which will produce, at a given temperature, a new composition, also varies by abrupt jumps, when the temperature is gradually made to vary by introducing into the mixture an inert gas. There will then exist several intervals of temperature, more or less great, between which the limit of the reaction is independent of changes of temperature. To establish a complete parallel between ethereal reactions and those of the gaseous systems, the influence of pressure upon the latter must be ascertained.

Between acetylene, hydrogen, and carbon reduced to vapour by the electric arc, or spark, such an equilibrium is established that a mixture of acetylene and hydrogen, made in suitable proportions, remains unaltered by the spark. If, on the contrary, acetylene predominates, it decomposes until the above-mentioned proportions are reproduced. These facts were established in a previous communication; since then I have submitted a mixture of acetylene and hydrogen to the action of the spark under different pressures. This is my method of operation:—

The gases were contained in large eprouvettes, into which were passed gas tubes, bent round and traversed by thick platinum wire. The spark produced by a strong induction coil passed direct between the platinum wires, without breaking upon the glass or any other cold body capable of suddenly condensing the carbon vapour. The pressure was measured directly by the height of a column of mercury, and the mixture was analyzed every hour, until the composition remained invariable during three consecutive tests. In the experiments made under very feeble pressure, it was necessary to repeatedly cleanse the eprouvettes containing the gaseous mixture, and, even then, to reject the first trials, because the formation of a small quantity of oxide of carbon proved the introduction of small quantities of air, or of moisture contained with the mercury. This oxide of carbon disappeared after the second or third trial, on care being taken to preserve from contact with the air the interior of the eprouvette and the tubes which conducted into it the platinum wire. The following results were obtained:—

Pressure. m.	Limit of Proportion of Acetylene in 100 volumes.
3·46	11·9
0·76	12·0 to 12·5 (in several trials).
0·42	11·9
0·41	12·0
0·31	6·5
0·23	3·5
0·18	3·1
0·10	3·1

The pressure was not reduced further, because the volume of gas under treatment would have been too small for correct analysis.

These numbers prove that the equilibrium between the carbon, hydrogen, and acetylene remained fixed at the same limit (12·0) for pressures which varied from 0·41 m. to 3·46m., that is to say, as 1 is to 8½.

The increase of pressure has no effect but to augment extremely the resistance to the passage of the spark, and also its brilliancy. According to my experience, this increase of brilliancy does not correspond with any change in the composition of the gas traversed by the spark.

Even the rapidity of decomposition, which causes the disappearance of the excess of acetylene under treatment, does not appear to vary much with pressure, as far as it was possible to judge under the circumstances. Below 0·41 m.—that is, at 0·31 m.—the limit is suddenly brought down to 6·5—viz., half the preceding one. At 0·23 m., the limit is suddenly reduced to the quarter of it, and remains the same, at least to 0·10 m.

Thus, while the pressure varies continually, the equilibrium between the acetylene, carbon, and hydrogen changes by sudden leaps, in ratios which are multiples of each other.—*Comptes Rendus*, vol. lxviii. p. 810.—*Chemical News*, Jan. 7.

WHAT'S IN AN OYSTER'S STOMACH?

BY THE REV. J. B. READE, M.A., F.R.S.

TO the *gourmet* the question does not possess many attractions, but to the man of science it is fraught with interest. It is especially so at the present moment, when so much is being said, and so little is being established, as to the food of the creatures which live in even greater depths than those of Schiller's "Diver"; and, above all, when Mr. Gwyn Jeffreys is in such an uncomfortable state of mind as to the original source of carbon in the food of foraminifera. It is curious to note that some very exact information on the above subject was given by the Rev. J. B. Reade, in 1844, in a paper read before the Microscopical Society, and which we have the pleasure of reproducing in part from the pages of *Land and Water*:—

The well-known ciliary currents in the fringes of the oyster induced me to examine the contents of the stomach, under the expectation of finding some minute forms of Infusoria; for it seemed but reasonable to infer that the absence of locomotive power and the consequent inability of seeking for food, might be compensated by so beautiful a contrivance for insuring constant nourishment. My expectations were fulfilled and surpassed. In the stomach of every oyster I examined, and in the alimentary canal, I found myriads of living monads, vibrios in great abundance and activity, and swarms of a conglomerate and ciliated living organism, which may be named *Volvox ostrearius*, somewhat resembling the *V. globator*, but of so extremely delicate a structure that it must be slightly charred to be rendered permanently visible.

This result, though highly interesting in itself, and marking so clearly the especial function of those instruments which fit the oyster for its peculiar place in the scale of created beings, is nevertheless of inferior importance, in a geological point of view, to some other results to which the presence of other infusoria in the stomach of the oyster conduct us. These infusoria I will briefly enumerate. They have silicious loricæ, and belong to the family of the Bacillariæ, and some of these in their fossil state constitute the chief bulk of the chalk.

They are the following:—*Actinocyclus senarius, Ceratoneis fasciola, Coscinodiscus minor, C. patina, C. radiatus, Dictyocha aculeata, D. fibula, D. speculum, Gallionella sulcata, Navicula entomon, Tripodiscus Argus, Xanthidium furcatum, X. hirsutum, Zygoceros rhombus, Z. Surirella*, and two new species of this genus.

All the above, together with some well-known recent species of the same extensive family of the Bacillariæ, I have found in the stomachs of oysters. That they are not the detritus of chalk or chalk-marl, although identical as to species with the fossils of the chalk, is decided by the fact of my finding several of them alive; and even in the dead specimens there are the same distinct remains of organic details which enabled Ehrenberg to pronounce with perfect accuracy that many similar dead forms have been recently in a living state. If further proof be required it may be furnished by the process of charring, which immediately blackens the yellow membranous integument of several of the species.

We must not expect to find the same species of infusoria in this new locality during every period of the year. Like creatures of a larger growth, oysters live on the food which is successively in season; and I find, in point of fact, that even a different shore is marked by a decided difference in the infusorial contents of the stomach. The "Scotch Natives" are characterized at the present time by innumerable circular forms, resembling the Coscinodiscus. Our own oysters, on the contrary, are nearly destitute of these living rotatory disks, but they are much richer in more interesting species; and in addition to the silicious-shelled infusoria which are received into their stomachs, they also occasionally furnish examples of calcareous Polythalamia adhering to the inner surface of their shells. These latter microscopic cephalopods form part of the proper food of shrimps, and accordingly I find that very minute Rotalia pass into the stomachs of shrimps entire.

The comparison which Ehrenberg has conducted so successfully between the chalk and recent infusoria, I have attempted to extend one step lower in the oolitic series, and to embrace in the investigation the infusoria of the Kimmeridge clay. The large oyster-beds which occur in this stratum in my own locality, the vale of Aylesbury, very naturally invite the search for the food of these ancient mollusks. It will be admitted that they lived, like recent oysters, upon infusoria, and that they possessed the same beautiful mechanism, though we cannot now detect it, for making a current of food set in in the direction of their stomachs. The very structure then of the oyster, independent of the result of any examination, determines the fact of the contemporaneous existence of infusoria, and their number may be approximately indicated by the countless bivalves they were appointed to sustain. The supply would be equal to the demand, and, moreover, of so vast an extent, that the conclusion is unavoidable that the Kimmeridge clay, like the chalk, is formed very largely of organic bodies, and is not the mere comminuted detritus of more ancient and unorganized materials.

The result of examination confirms this view. I find in the Kimmeridge clay vast numbers of circular disks, already alluded to as existing in living oysters, and in addition to these I have met with decided examples of the Coscinodiscus, and portions of calcareous shells of Polythalamia. Under these circumstances we cannot fail to suspect an absolute identity between the genera and species of some of the minute and simple occupants of ancient and modern seas, though larger forms of more complicated mechanism have successively risen and disappeared. The oyster dissimilar from ours may have fed upon our own Volvox, the Volvox on the Monad, and the Monad—but here we must pause, lost among the wonders of the ever-living and life-giving Creator.

From the nature of the present inquiry it may be extended, theoretically at least, beyond the Kimmeridge clay. On the evidence of analogy we may assume that the inhabitants of all bivalve shells, not only in the secondary, but also in the seas of the transition formation, were of similar habits to the acephalous mollusk which constructs the oyster shell; that being destitute of jaws, tongue, or mouth, the action of a ciliary apparatus supplied them with food; and that their food consisted of an order of animals adapted, by their minuteness, to the delicate mechanism of the cilia, and designed, by their multi-

plication almost to infinity, to add mountain masses to the solid crust of the earth. We may hereafter be indebted to the microscope for the confirmation of these views.

I may embrace the present opportunity of further illustrating the use of the microscope in geological researches by making a passing remark on the degree of heat to which the Kimmeridge clay has been subjected. Microscopic crystals of carbonate of lime, which abound in large portions of it, are either perfect cubes, or much nearer approximations to the cube than is consistent with their primitive form. That this alteration of the angle is due to the action of heat, and that the degree of heat is indicated by the angle ultimately assumed, is evident from the following remark by Professor Brande:—"The temperature appears to affect the mutual inclinations of the planes of crystals. In the case of carbonate of lime it amounts, according to Mitscherlich, to as much as 8·5′ in the interval of temperature between 32° and 112°. As the temperature augments, the smaller axis of the rhomboid dilates more than its other diagonals, so as to cause an approach to the cubical form."

It is my chief object, however, to show with Ehrenberg, that animals of the chalk are still found in a living state; and having done this it is needless, with Ehrenberg's paper in our hands, to point out at any length the importance of these researches. They bear directly upon mountain masses, and seem to make the vast chalk-range overstep its boundary and connect itself rather with the tertiary and recent than with the primary and transition formations. Beyond all doubt the bulk of the cretaceous series is composed of organisms still living, as I have now shown in our own British seas, and, as Ehrenberg observes, still capable, under the concurrence of favourable circumstances, of giving rise to the greatest changes in the distribution of the solid crust of the earth. The material and not the magnitude of infusoria is the proper element in these calculations. We must shut our eyes to the minuteness of each individual atom of life, and look rather at the marvellous activity of its law of increase, and at its indestructible shield, which sets at defiance the two great reducers of organic structure, death and fire. A very few nutshells would hold all that would be left of an elephant if reduced to its ultimate elements by fire, but no known intensity of heat would reduce the silicious mass of infusoria. Fusion, under certain conditions, would be the utmost result, and thence would originate other mountain masses, which, to say the least, would be very nearly allied to those which we term granitic. The question, then, is not unreasonable—was granite originally an infusorial earth?—and we accept Ehrenberg's hypothesis as the reply: "Since of the four well-established great geological periods of the earth's formation, the quarternary, tertiary, and secondary formations contain recent organisms, it is as three to one more probable that the transition or primary formation is not differently circumstanced, but that, from the gradual longer decomposition and change of many of its organic relations, it is more difficult to examine and determine."

VARIATIONS IN THE APPEARANCE OF THE LUNAR PLAIN "PLATO."

BY W. R. BURT, F.R.A.S.

NE of the most promising lines of research having reference to the physical aspect of the moon's surface, consists in an examination from time to time of the tints which characterize every portion of the visible disk. To take this in its entirety would be a most enormous labour; the only way to deal with a subject of this kind is to select a few of the most prominent objects which differ in brightness and colour, and regularly observe them at stated intervals; if even half a dozen such objects were selected and observed on every occasion when the moon appeared above the horizon, as the observations proceeded it would be found that not only a large amount of labour must be expended before any valuable results could be obtained, but the observations must be continued over a long period of years to eliminate the effects of those agencies which produce merely apparent changes. That changes of tint and brilliancy occur on the moon's surface is very evident; no lunar observer is ignorant of the fact that many portions of the surface vary in tint during the course of the luni-solar day; the variation of brilliancy in many of the brighter spots is still more marked during the same period, and these variations have been referred, probably with great truth, to the change of angle at which the sun's light falls upon the objects, but up to this time we are really destitute of the "proof" of this being actually the case. The scales of tint and brilliancy adopted by the three leading selenographers of the present century differ from each other, and the observations which have been referred to solar altitudes and azimuths are so exceedingly few, that *legitimately* to connect variations of brilliancy with change of illuminating angle is quite out of the question; still, the presumption is strong that the most striking changes of tint and brilliancy are connected with variations of illuminating angle. It is not, however, light alone that affects the objects in the way observed; the nature of the materials of which they are composed plays an important part, some reflecting more, some less light than others.

When we enter upon a comparison of tints, either observed directly by means of the telescope or recorded on photograms, with those given on our maps or recorded in the works of selenographers, we are often struck with the differences thus detected; but as we fail to connect by ordinary inductive processes apparent variation of brightness with change of illuminating angle, simply on account of the absence, on the one hand, of a suitable scale of brightness, and, on the other, of a discussion of the observations with respect to solar altitudes and azimuths; so with regard to the differences just alluded to, we fail to refer them to change of a physical character, just because we are destitute of the necessary evidence that the spots were really darker or lighter than they are at present.

While the scales of Schröter, Lohrmann, and Beer and Mädler differ among themselves, the tints or brilliancy ascribed by each selenographer to the objects recorded by him are comparable one with the other upon his particular scale, and thus a means exists of ascertaining at the epoch of each whether one of any two spots was brighter or darker than the other at the phase at which the brilliancy was determined. It is obvious that now, observations of the brightness of the same two spots may be obtained at about the same phase, provided the suitable opportunities be embraced, and thus a change of brilliancy or tint may be detected of a different character to that dependent on change of illuminating angle; for if the observations be made at precisely the same phase as when the brightness was recorded, it is clear that the illuminating angle must be nearly if not quite the same; consequently the variation of tint or brightness in one or both of the two spots must be referred to some agency differing from illumination.

Last year I solicited the attention of the section to the difference of tint which characterized a somewhat large shallow crater near Alpetragius, as compared with the drawings of Lohrmann, Beer and Mädler, and Schmidt. The floor of this crater was seen to be *darker* in 1868 than the surrounding surface, and therefore darker than delineated by the selenographers just named. The same dark tint, under every phase at which it has been examined, has been observed without exception since August, 1868. The legitimate conclusion is, that during the period of the observations in 1868 and in 1869, the surface of this crater was permanently the *darkest* in the neighbourhood. If Lohrmann, Beer and Mädler, and Schmidt were correct in their comparative delineation of the tint of this crater (and it is difficult to conceive that three experienced selenographers could have fallen into the same error), we have

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presumptive evidence of a phenomenon which may be termed "a secular variation of tint." What it arises from is altogether another question; it, however, does not stand alone on the surface of the moon.

To enter into any speculation as to the cause of such variations, whether from bright to dark, or the reverse, is manifestly premature; there is, however, a class of phenomena which bears much on the same point; the surfaces of many of the larger smooth-walled plains are greatly diversified with spots, streaks, and in some cases spreading fans of light; the rays issuing from Proclus and spreading over the Mare Crisium may be cited as examples of the latter. The walled plain Plato has been the subject of numerous observations, both as regards its very interesting mountain border and still more interesting floor. No two drawings of this floor that I have seen precisely agree—a result to be expected when we consider that the differences of illuminating and visual angle tend materially to influence its aspect as seen from the earth, added to which, we have the different impressions produced at different times on artists and observers. Still, the differences dependent upon illumination, &c., will have a limit; certain well-known features will always be recognized, although somewhat altered in appearance at different times. It is after a lapse of years that a well-conducted series of observations will determine if there be secular change in these stripes and tints. Should some disappear, and others not observed before become visible, the presumptive evidence is that a secular change has taken place. This appears to be the case with several spots on Plato. The earliest record that I have been able to find of any well-defined small spots on the floor is that of Gruithuisen, who observed eight; later records furnish evidence of eighteen additional spots having been observed. Of these, nine have been added so recently as last February and since. Of the twenty-six recorded, six of the earliest observed are still visible; and of the nine seen since January last five have been more or less constantly seen by two observers, leaving fifteen which have either become invisible or are very rarely seen.

When the sun is rising upon Plato the shadows of the peaks on the western wall are admirably calculated to identify certain of these spots, and probably of deciding between craters opened on the floor of Plato and those small white spots to which Herr Tempel solicits attention as indicative of a *warm chemical activity*, and which appear under a high solar illumination, there being no indication whatever of craters existing on their sites as the terminator passes them.

Beer and Mädler measured the peaks on the western walls—viz., γ, δ, and ϵ, the heights being as under:—

$\gamma = 7{,}258$ Eng. ft., $\delta = 6{,}369$ Eng. ft., $\epsilon = 5{,}128$ Eng. ft.

Challis measured the shadows on May 16, 1853. The measures were made parallel and perpendicular to a line coincident with the longest diameter of Plato. At the time Challis observed Plato nine spots had been recorded as having been seen on the floor, four of which were delineated by Challis, numbered 1, 3, 4, and 5. They have since been observed by Rosse, Dobie, Dawes, and Pratt, and some of them by Knott and other observers.

Rosse in 1862, Dawes in 1863, and Birmingham in 1869, observed the shadow of the peak γ in close proximity with No. 5 (?). Rosse and Birmingham have drawn No. 1 with the shadow of δ just receding from it, and Birmingham gives No. 3 at the extremity of the shadow of the northern peak ϵ. As matter of observation these are important; for by the variations of the seasons at the moon the shadows will fall somewhat differently in summer than in winter; the extreme range is, however, but small, the azimuthal angle with the same altitude not exceeding 3°; and as solar azimuths at the moon are easily calculated, no real difficulty exists in identifying these spots as lying near the shadows of the peaks. The peaks themselves merit attention; Challis's shadow of δ terminates by a straight line; he measured the two extremities of this line. Rosse delineates the termination of the shadow as from two pinnacles upon the summit, with the crater No. 1 between them. Birmingham gives the south pinnacle only, with the crater No. 1 just beyond it. In Dawes's drawing No. 1 lies between the shadows of γ and δ. There are other peculiarities about the shadows which require the solar azimuths to be calculated for illustrating them. It is to be hoped that good drawings, accompanied by descriptions of the shadows of the west wall and craters visible on the floor, will be *multiplied*, as in referring such drawings and descriptions to the respective periods at which they were made in the luni-solar year, we may become better acquainted with the nature of the summit of the wall and by means of large apertures, small craters on the floor hitherto overlooked, may be detected.

Although this branch of lunar physics is confessedly difficult, it is by no means insurmountable. The greatest drawback consists in the paucity of recorded observations of an earlier date, from which arises the uncertainty of the existence of the more recently observed spots. The way, however, for precise observation and careful discussion is gradually opening, and we may hope that Schmidt's suggestion of "trying by the aid of more powerful telescopes to represent the topography of the yet undelineated details of the surface of the moon," may bear good fruit, although the further we proceed, the more unable are we to see the end of the work. "It is," says Schmidt, "as if from the ordinary determination of place of the brighter stars down to the eighth magnitude, one passes on to that of the stars of the Milky Way." So, in like manner, each addition to our knowledge of lunar physics leads us onward to the study of still more minute forms, in which perhaps lurk the germs of future interesting and important discoveries.—*From the Report of the British Association for the Advancement of Science for* 1869.

ON THE STRUCTURE OF THE ADVENTITIOUS ROOTS OF THE PORTUGAL LAUREL.

BY W. R. M'NAB, M.D. EDIN.

In the month of October of last year, many of the branches of the Portugal laurels in the grounds of the Crichton Royal Institution, Dumfries, became covered with patches of adventitious roots. These adventitious roots were submitted to a careful microscopic examination, and were found to present the usual histological characters of true roots. They arise in patches, more or less large, from the branches, but not in any regular order, their position on the branch not giving any clue to their relative age. The bark was always ruptured and pushed aside by the rootlets, showing that they have a deep-seated and not a superficial origin. Sections made in various directions showed that the roots are in direct relation to the cambium layer; and, in certain sections, the medullary rays could be traced for some distance into the adventitious root. All the cells of the medullary rays in the neighbourhood of the rootlet were filled up with small rounded starch granules, which gave the characteristic blue reaction with iodo-chloride of zinc solution. The apex of the root was covered with the mass of loose cells common to ordinary roots, and forming a slightly-developed pileorhiza. When sections were placed in carmine solution, the active cells at the growing point became, as usual, brightly coloured. One section was left, by mistake, for a long time in the carmine solution; this, when taken out and carefully washed, showed a coloured matrix, in which the apparently loose cells were immersed. These cells, although apparently loose, can be always removed with the section from slide to slide. It is thus probable that the cells, instead of being loose as described, are more or less immersed in a gelatinous matrix, probably due to the degeneration of the primary cell-wall. I have not been able to get the same appearance again, as the rootlets were all destroyed before the above observation was made. The appear-

ance was certainly not due to some of the colouring matter remaining between the cells, as every attempt was made to remove it without success. The only difference between these adventitious and true roots is in their position and irregular mode of growth. In their growing by addition to the growing point, and in histological characters, they are undistinguishable from true roots. Root hairs were also produced in abundance by the epidermis.—*The Farmer.*

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From January 10th to 16th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Long-eared Owl (Otus vulgaris)	British Islands	Presented by W. Unwin, Esq.	Owl's Aviary
2 Puff-Adders (Clotho arietans)	Cape of Good Hope	Presented by Captain Thomas Waite	Reptile-house
3 Pairs Wigeon (Mareca penelope)	Europe	Purchased	Three Island Pond
1 Great Eagle Owl (Bubo maximus)	Ditto	Presented by C. Bamford, Esq.	Owl's Aviary
1 Wood Owl (Syrnium aluco)	Ditto	Presented by R. E. L. Wade, Esq.	Ditto
1 Common Kestrel (Tinnunculus alaudarius)	British Islands	Ditto	Winter Aviary
1 Little Armadillo (Dasypus minutus)	Bolivia	Purchased	Anteater's-house

VOLCANOES AND EARTHQUAKES.

BY T. STERRY HUNT, LL.D., F.R.S.

IN TWO PARTS.—PART II.

THIS theory of Hopkins and Scrope, apparently so complete in itself, is an approximation to the one which I adopt, though differing from it in some most important particulars. While admitting with them the existence of a solid nucleus and a solid crust, with an interposed stratum of semi-liquid matter, I consider this last to be, not a portion of the yet unsolidified igneous matter, but a layer of material which was once solid, but is now rendered liquid by the intervention of water under the influence of heat and pressure. When, in the process of refrigeration, the globe had reached the point imagined by Hopkins, where a solid crust was formed over the shallow molten layer which covered the solid nucleus, the farther cooling and contraction of this crust would result in irregular movements, breaking it up, and causing the extravasation of the yet liquid portions confined beneath. When at length the reduction of temperature permitted the precipitation of water from the dense primeval atmosphere, the whole cooling and disintegrating mass of broken-up crust and poured-out igneous rock would become exposed to the action of air and water. In this way the solid nucleus of igneous rock became surrounded with a deep layer of disintegrated and water-impregnated material, the ruins of its former envelope, and the chaotic mass from which, under the influence of heat from below and of air and water from above, the world of geologic and of human history was to be evolved.

As we descend in the sedimentary crust of the earth, we observe a regular increase of temperature, due, as is supposed, to the slow upward passage of the central heat. In the present state of refrigeration this process is so slow that the increase of temperature in descending is only about one degree Centigrade for each hundred feet; but if we admit the hypothesis of a cooling globe, it can be shown that in early geologic ages this increase must have been tenfold, or even twenty-fold greater than at present. As this augmentation of temperature in depth obeys the same law alike in the newest and the oldest formations, it follows that the accumulation of sediment at any time and place will result in a slow rise in temperature of the portion covered thereby, so that a deposit of a few miles in thickness in comparatively recent ages, and probably one of as many thousands of feet in the Laurentian or even the palæozoic period, would, after a lapse of time, so elevate the temperature of the buried portions as to produce new chemical and mechanical arrangements of the sediments. The expansive action of heat upon these porous materials, which generally include several hundredths of water, would soon be counteracted by the great contraction following chemical combination, resulting in the formation of new and denser compounds, which constitute the crystalline and metamorphic rocks. The action of silicious matters in the presence of water, aided by heat, upon the various carbonates, chlorides, sulphates, and organic matters which abound in most sedimentary formations, would generate the acid gases which are so often evolved in volcanic eruptions. It must be borne in mind that water under pressure, and at high temperatures, develops extraordinary solvent powers; while from what has already been said of the influence of pressure in favouring solution, it will be seen that the weight of the overlying mass becomes an efficient cause of the liquefaction of the lower portions of the sedimentary material. Time is wanting to discuss the great forces which from early geologic periods have been active in transferring sediments, alternately wasting and building up continents. By the depression of the yielding crust beneath regions of great accumulation there follows a softening of the lower and of the more fusible strata, while the great mass of more silicious rocks becomes cemented into comparative rigidity, and finally, as the result of the earth's contraction, rises a hardened and corrugated mass, from whose irregular erosion results a mountainous region.

Those strata, which from their composition yield under these conditions the most liquid products, are, it is conceived, the source of all plutonic and volcanic rocks. Accompanied by water, and by difficultly coercible gases, they are either extravasated among the fissures which form in the overflowing strata, or find their way to the surface. The variations in the composition of lavas and their accompanying gases in different regions, and even from the same vent at different times, are strong confirmations of the truth of this view, to which may be added the fact that all the various types of lava are represented among aqueous sedimentary rocks, which are capable of yielding these lavas by the process of fusion.

The intervention of water in all lavas, of which it appears to form an integral part, was first insisted upon by Scrope, and is a fact hardly explicable upon any other hypothesis than the one just set forth. Considering the conditions of its formation, water would seem to be necessarily absent from the originally fused globe, in which the older school of geologists conceive volcanic rocks to have their source. Scheerer supplemented Scrope's view by showing that the presence of a few hundredths of water, maintained under pressure at a temperature approaching ignition, would probably suffice to produce a quasi-solution or an igneo-aqueous fusion of most crystalline rocks, and subsequent observations of Sorby have demonstrated that the softening and crystallization of many granites and trachytes must have taken place in the presence of water, and at temperatures not above a low red heat. Keeping in view these facts, we can readily understand how the sheet of water-

impregnated *débris*, which, as we have endeavoured to show, must have formed the envelope to the solid nucleus, assumed in its lower portion a semi-fluid condition, and constituted a plastic bed on which the stratified sediments repose. These, which are in part modified portions of the disintegrated primitive crust, and in part of chemical origin, by their irregular distribution over different portions of the earth, determine, after a lapse of time, in the regions of their greatest accumulation, volcanic and plutonic phenomena. It now remains to show the observed relations of these phenomena, both in earlier and later times, to great accumulations of sediment.

If we look at the North American continent, we find along its north-eastern portion evidences of great subsidence, and an accumulation of not less than 40,000 ft. of sediment along the line of the Appalachians from the Gulf of St. Lawrence southwards, during the palæozoic period, and chiefly, it would appear, during its earlier and later portions. This region is precisely that characterized by considerable eruptions of plutonic rocks during this period and for some time after its close. To the westward of the Appalachians the deposits of palæozoic sediments were much thinner, and in the Mississippi valley are probably less than 4,000 ft. in thickness. Conformably with this, there are no traces of plutonic or volcanic outbursts from the north-east region just mentioned throughout this vast palæozoic basin, with the exception of the region of Lake Superior, where we find the early portion of the palæozoic age marked by a great accumulation of sediments, comparable to that occurring at the same time in the region of New England, and followed or accompanied by similar plutonic phenomena. Across the plains of northern Russia and Scandinavia, as in the Mississippi valley, the palæozoic period was represented by not more than 2,000 ft. of sediments, which still lie undisturbed, while in the British Islands 50,000 ft. of palæozoic strata, contorted and accompanied by igneous rocks, attest the connection between great accumulation and plutonic phenomena.

Coming now to modern volcanoes, we find them in their greatest activity in oceanic regions, where subsidence and accumulation are still going on. Of the two continental regions already pointed out, that along the Mediterranean basin is marked by an accumulation of mesozoic and tertiary sediments 20,000 ft. or more in thickness. It is evident that the great mountain zone which includes the Pyrenees, the Alps, the Caucasus, and the Himmalayah was, during the later secondary and tertiary periods, a basin in which vast accumulations of sediments were taking place, as in the Appalachian belt during the palæozoic times. Turning now to the other continental region, the American Pacific slope similar evidences of great accumulations during the same periods are found throughout its whole extent, showing that the great Pacific mountain belt of North and South America, with its attendant volcanoes, is, in the main, the geological equivalent or counterpart of the great east and west belt of the eastern world.

It is to be remarked that the volcanic vents are seldom immediately along the lines of greatest accumulation, but appear around and at certain distances therefrom. The question of the duration of volcanic activity in a given region is one of great interest, which cannot, for want of time, be considered here. It appears probable that the great manifestations of volcanic force belong to the period of depression of the area of sedimentation, if we may judge from the energy and copiousness of the eruptions of island volcanoes, although the activity is still prolonged after the period of elevation.

As regards the geological importance of volcanic and earthquake phenomena, their significance is but local and accidental, Volcanoes and earthquakes are and always have been confined to limited areas of the earth's surface, and the products of volcanic action make up but a small portion of the solid crust of the globe. Great mountains and mountain chains are not volcanic in their nature or their origin, though sometimes crowned by volcanic cones; nor are earthquakes and volcanoes to be looked upon as anything more than incidental attendants upon the great agencies which are slowly but constantly raising and depressing continents.

The theory of volcanic phenomena here set forth was first partially indicated by Keferstein in 1834, and subsequently and apparently independently by Sir John Herschel in 1837. It, however, attracted little or no attention until, in 1858 and 1859, I again brought it forward, and endeavoured to show its conformity with the facts of chemistry, physics, and geognosy. In the hasty sketch of it here given, the chemist, the geologist, and the geographer will alike discover points which require elucidation or provoke criticism, but will I hope find, nevertheless, a concise and intelligible statement of the theory of earthquakes and volcanoes which appears to me more in harmony with the known facts of science than any other hitherto advanced.[1]—*Lecture recently delivered.*

PLANTS IN SLEEPING-ROOMS.

BY DR. J. C. DRAPER.

HOUGH the air is dependent for the renewal of its oxygen on the action of the green leaves of plants, it must not be forgotten that it is only in the presence and under the stimulus of light that these organisms decompose carbonic acid. All plants, irrespective of their kind or nature, absorb oxygen and exhale carbonic acid in the dark. The quantity of noxious gas thus eliminated is, however, exceedingly small when compared with the oxygen thrown out during the day. When they are flowering, plants exhale carbonic acid in considerable quantity, and at the same time evolve heat. In this condition, therefore, they resemble animals as regards their relation to the air; and a number of plants placed in a room would, under these circumstances, tend to vitiate the air.

While the phanerogamia, or flowering plants, depend on the air almost entirely for their supply of carbon, and are busy during the day in restoring to it the oxygen that has been removed by animals, many of the inferior cryptogamia, as the fungi and parasitic plants, obtain their nourishment from material that has already been organized. They do not absorb carbonic acid, but, on the contrary, they act like animals, absorbing oxygen and exhaling carbonic acid at all times. It is, therefore, evident that their presence in a room cannot be productive of good results.

Aside from the highly deleterious action that plants may exert on the atmosphere of a sleeping-room, by increasing the proportion of carbonic acid during the night, there is another and more important objection to be urged against their presence in such apartments. Like animals, they exhale peculiar volatile organic principles, which in many instances render the air unfit for the purposes of respiration. Even in the days of Andronicus this fact was recognized, for he says, in speaking of Arabia Felix, that "by reason of myrrh, frankincense, and hot spices there growing, the air was so obnoxious to their brains, that the very inhabitants at some times cannot avoid its influence." What the influence on the brains of the inhabitants may have been does not at present interest us: we have only quoted the statement to show that long ago the emanations from plants were regarded as having an influence on the condition of the air; and, in view of our present igno-

[1] In justice to myself, it should be said that at the time this lecture was delivered I had no knowledge of Professor J. D. Whitney's excellent and suggestive paper on earthquakes, which appears in the *North American Review* for April, 1869. The relation of modern volcanic phenomena to great accumulations of newer secondary and tertiary rocks, and the connection of the foldings and contortions of sedimentary strata with great thicknesses of the same, are set forth by me in several papers, the chief of which may be found in the *Canadian Journal* for May, 1858, the *Geological Journal* for November, 1859, and the *American Journal of Science* for July, 1860 (vol. xxx. p. 133), and also for May, 1861 (vol. xxxi. pp. 406-414), where the important contributions of Professor James Hall, bearing upon this question, are noticed at length.—*T. S. H.*

rance, it would be wise to banish them from our sleeping apartments, at least until we are better informed regarding their true properties.—*The Galaxy (U.S.).*

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

THE MIOCENE FLORA.

BY J. MORRIS, F.G.S.

Professor of Geology in University College, London.

THE study of the lower and middle tertiary floras ha of late years occupied the attention of botanists and geologists, and important memoirs have been published by Heer, Gaudin, Goeppert, Unger, Saporta, and Ettinghausen, more especially respecting the vegetation of the Miocene period. The character of these floras is not only interesting from their being the precursors and probable origin of the later and recent flora, but as showing the nature of the vegetation of those epochs, as well as the physical geography of the period; for all land plants must either have been imbedded on the spots where they grew, or drifted into and associated with the estuarine and marine strata then in progress of formation. In this respect the distribution of the Miocene flora is very suggestive, considering the large area over which it has been traced, and the resemblances and differences in the various localities, either as representative or identical species, would seem to indicate a land connection between the continents at that period. The Report on the Cretaceous and Tertiary Plants, by Dr. Newberry, before noticed (No. 62 p. 16), is further illustrative of the subject. The largest collection of these Miocene plants was made by Dr. Hayden, at various points on the Upper Missouri. About fifty species are noticed, of which three occur on the west coast, two in Arctic America, three in the European Miocene, and three are considered identical with living species. One of these, a fern, *Onoclea sensibilis*, occurs also on the Island of Mull (the *Felicites hebridicus*, Forbes), which, however, has not been found in the tertiary beds of other parts of Europe, and is indicative (says Dr. Newberry) not only of an American connection during the Miocene period, but of an American origin for that species, and so, by inference, of the other genera and species common to the two continents during that epoch: so that the climate of the connecting land between America and Europe differed from that at the present time; for we find on M'Kenzie's River, Disco Island, on Iceland and the Island of Mull, the recurrence of parts of the same flora, affording proof not only of a warmer climate at the far north during the Miocene epoch, but that a part of the plants which formed the Miocene flora of Europe did travel by the land now isolated of Greenland, Iceland, and the Hebrides. Again, the Azores, Madeira, and the Canaries have been considered as the remains of a vast continent which at one time was joined to America. Professor Oliver considered there was a communication from America to Eastern Asia along the direction of the Aleutian Isles. Dr. Hayden's researches seem to prove that this Miocene lignite formation occupies the beds of extensive lakes which filled deep basins on the surface of the continent when it had emerged from the cretaceous sea, the lower members only of the series containing estuary shells, the upper being freshwater forms. The general resemblance, and even identity, of some species of the American flora to that of Europe strikingly shown in the species of Sequoia, Glyptostrobus, Taxodium, Sabal, and Popolus; while two species of Corylys cannot be distinguished from two living forms of the temperate portions of America. On the other hand, there are some striking deficiencies, as Liquidamber, Quercus, Magnolia, Acer, Liriodendron, and Sassafras—all of which are members of the Miocene strata of the Old World; the first three, however, occur in the Pliocene beds of New Jersey, and Magnolia and Quercus in the Miocene of the Mississippi valley.

The occurrence of fossil plants in Arctic latitudes which evidently lived on the spot, some of which are specifically identical with the Miocene forms of Switzerland, Germany, and England, is very interesting, especially when we compare the separate floras and their general relations to the existing vegetation. From the observations of MM. Heer and A. De Candolle, there are nine families of phanerogamous plants, which comprise about half the Swiss Miocene plants; of these the Leguminosæ are most abundant, then follow the Amentaceæ, and particularly the Cupuliferæ, the Cyperaceæ, the Proteaceæ (a family almost limited to the Cape and New Holland), the Laurineæ, the Compositæ, the Acerinæ, and a great number of Coniferæ. In the proportion of the families and the comparison of the living analogues, the Miocene vegetation somewhat resembled the present flora of the United States, Mexico, and Japan, modified by forms from the Mediterranean and intertropical regions, and even with Australia and Japan.

In the British Islands are the Miocene beds of Mull, Antrim, and Bovey, Devon; of the fifty species of plants from the latter locality, twenty-one occur also on the Continent, chiefly in lower Miocene or the Aquitanian stage of it—the Bovey flora in its southern character corresponding with that of the lower Miocene of Switzerland. Among the more noticeable forms are, *Sequoia Couttsæ*, two species of Cinnamomum, *Quercus Lyelli* (an evergreen oak), a palm, a vine, a fern, *Pecopteris lignitum*, species of Nyssa, a genus at present restricted to North America. Bovey has no species in common with Iceland, although two Iceland species have been found in Mull. Even the genera are distinct, with the exception of Sequoia and Quercus, which are represented by distinct species.

The Arctic Miocene flora contains 194 species, of which 137 have been discovered in Greenland; of these about one-third agree with those from the Miocene deposits of Europe, four of them, including *Sequoia Couttsæ*, being found at Bovey Tracey.

The existence and decay of this abundant arborescent and shrubby vegetation during the long Miocene period has not been without its economic results, for it has contributed to the coal deposits of Disco Island, the suturbrand of Iceland, the lignite seams of Antrim, Mull, and Bovey, and the thick beds of brown coal (thicker sometimes than the seams of the carboniferous period) of Prussia, Austria, and other parts of Europe, thus supplying in many localities the want of the older coal strata.

The Physical Structure of the Italians.—Professor Lombroso read an essay on this subject before the late International Medical Congress, in Florence. He states that the Italian at twenty-one years of age weighs, upon an average, 62 kilog. and 900 grammes; which exceeds by at least 10 kilog. the average weight of the French and Belgians, and is the same as that of the Russians of Kasan. People of low stature weigh proportionally more than those of high stature. The Neapolitans and Venetians are the tallest, the Sardinians and the Calabrians the shortest of the Italians. Where the people are shorter, the ox, the ass, and the horse, are also of smaller stature. Generally the inhabitants of large cities are taller than those in small cities. Blond hair is found more commonly among the Venetians and Lombards, black hair among the Romans, Neapolitans, and Calabrians. The climate exercises a great influence in this respect. The northern climate produces blond hair, the southern black; yet race is very often victorious over the influence of climate, and a few drops of Greek or Norman blood frequently suffice to give to a Sicilian blond hair. In respect to length of limb, the Calabrian is marked by the extraordinary length of his arm, the Venetian by that of his leg; the former, therefore, approaches more nearly the type of the ape. The author has measured more than two thousand skulls, from the twenty-first year and upwards, and finds that the cranial capacity is greatest in Tuscany, next in Venetia and Liguria, and least in Sicily and Sardinia.—(Reported in *Allg. Med. Central Zeitung.*)

A NEW THEORY OF THE MILKY WAY.

BY R. A. PROCTOR, B.A., F.R.A.S.

SIR W. HERSCHEL'S respect for existing analogies—a quality which is perhaps of all others the safest guide for the scientific explorer—led him to adopt as the means of interpreting his noble series of star-gaugings the hypothesis that there is a general uniformity in the distribution of the stars through space. He adopted this hypothesis not from a conviction of its being actually true, nor even from the belief that it is approximately so, but simply because existing analogies seem to render it probable, and because it formed a convenient basis for calculation. The existing analogies were those presented by the solar system. In this system Sir. W. Herschel recognized a number of discrete bodies, not equal indeed, but comparable *inter se* in magnitude; not uniformly distributed, but still not aggregated towards one or another part of the solar scheme. And making such modifications as seemed requisite in comparing a system not regulated by a vast central orb with a scheme like our solar system, it seemed likely to him that a general equality of magnitude, and a general uniformity of distribution, might be found to prevail among the members of the sidereal system.

We now know that the ideas which astronomers had formed of the solar system in Sir W. Herschel's day were very far indeed from being correct. We see in the solar system a complexity of detail and a variety of form, structure, aggregation, and motion, which were altogether unknown a century ago. And I cannot doubt that if the view we have of the solar system had been presented to Sir W. Herschel, he would have adopted as the basis of his star-gaugings an hypothesis differing altogether from that of which he actually availed himself. He would have argued that, as in the solar system there are bodies like the planets, far surpassing the other members of the scheme in magnitude and in importance; as it contains zones of minute bodies, such as the asteroids and the satellites composing the rings of Saturn; myriads of meteoric systems and countless thousands of cometic systems, so doubtless in the sidereal system there are many forms of matter. If the analogy of the solar system is to be our guide, we must look for suns equalling or surpassing our own in magnitude and splendour; for clusters and systems of minor suns, whose united mass may fall short of the mass of one of the primary stars; for aggregations of matter in portions relatively so minute as not even to be comparable with the small stars found in true star-clusters; and finally for systems composed of materials, or at least of forms of matter, differing as widely from the substance of the suns as the matter composing the comet does from the substance of the earth or of Jupiter.

But, even independently of analogies such as these, his own series of observations led Sir W. Herschel to feel more and more doubt, as he proceeded, respecting the hypothesis which he had made the basis of his calculations. It is only necessary to compare the later papers he sent in to the Royal Society with the earlier ones, to find that views altogether inconsistent with his initial hypothesis were opening out before him. It was in those later papers that he spoke of star-groups in the Milky Way clustering towards opposite regions of the heavens; of stars arranging themselves into separate systems; and of the signs which the heavens present of the action of processes of aggregation, causing "the gradual dissolution of the Milky Way."

Sir John Herschel, also, in carrying out the system of star-gauging among the Southern stars, was led to notice many features which the hypothesis of a tolerably uniform distribution of stars could not satisfactorily explain.

Judged according to Sir W. Herschel's fundamental hypothesis, the sidereal system came to be regarded as forming a figure resembling that of a cloven disk, and the Milky Way was explained as being due simply to the greater extension of the system in the direction of the medial plane of this disk. Sir John Herschel, however, from his observations of the Southern heavens, was led to suspect that this theory was not strictly correct. He speaks in one place of certain evidence, according to which the Milky Way would come to be regarded as a flat ring seen edge-wise. And in many places he speaks of the difficulty of understanding certain features according to the views usually accepted.

It seems to me that the evidence collected respecting the Milky Way is sufficient to lead us to quite another view of its structure than that to which Sir W. Herschel was led by an hypothesis founded on the incomplete theories which astronomers in his day had formed respecting the solar system.

Let us regard the matter altogether independently of preconceived opinions, and judge simply as the evidence may seem to teach us.

In the woodcut (see page 69), the outer figure represents the Milky Way according to the drawings and description of Sir John Herschel. The mode in which it is delineated needs no explanation.

Now, in regarding this picture of the Milky Way, we are forced, I think, to the conclusion that neither the cloven-disk theory, nor the flat-ring theory, accounts satisfactorily even for the principal features of the Milky Way. For example, the great gap which crosses it in Argo, nearly in the widest part of the single branch, seems utterly inexplicable on either theory. There is no way of accounting for that gap if we are really supposed to view the Milky Way from a point within its figure, and that figure resembles—however roughly—either a cloven disk or a flat ring.

But let us pass to other features. Travelling towards the right from the gap, we come to the strange semicircular cavity with a well-defined outline, which Sir John Herschel has described in such striking terms. A cavity of that figure is a remarkable phenomenon, and is surely inexplicable either on the flat-ring or cloven-disk theory. But the mere distinctness of the outline is one of the strongest possible proofs that the stars which form that portion of the Milky Way constitute a distinct clustering aggregation from which we are separated by an enormous and comparatively starless interval.

We come next to the Great Coal-sack near Crux, almost opposite to which is a well-marked opening in Cygnus. There are also other strange openings through different parts of the Milky Way.

Now I cannot but think that an argument similar to that which Sir John Herschel has applied with so much force to the Magellanic clouds applies to the openings in Crux and Cygnus. He argues that because the Magellanic clouds approach roughly to the circular figure, therefore, in all probability, their real figure is that of a sphere: the chance is small that one of them is a cylindrical system seen endwise, but the chance that both are is altogether evanescent. Now applying the same principle to the Coal-sacks, we are led with equal certainty to the conclusion that these apertures are not cylindrical or tunnel-shaped openings seen endwise, but *if they are really openings at all* they are openings through a system which is not very much deeper—measured in the direction of the line of sight—than the greatest width of the aperture itself.

Judged in this way, the parts of the Milky Way which lie round a "Coal-sack" would have a roughly circular section, and not that enormous extension in the direction of the line of light, which has been assigned to them.

I cannot see that this argument is at all less sound or less effective than that which has been applied by Sir John Herschel to the Magellanic clouds.

There is another feature referred to, and I believe discovered, by Sir John Herschel, which is also full of meaning. I refer to the existence of narrow and sometimes convoluted streams of stars, branching out from the Milky Way itself. Sir John Herschel says of these that we ought to look on them as in all probability planes or scrolls of stars seen tangentially, and not as branch-shaped extensions bristling up from the general level

of the Milky Way. And undoubtedly if the Milky Way really have a great extension in the direction of the line of sight, it is just that we should so regard these outlying streams. But if we judge of them without any reference at all to pre-existing theories, we are guided by strong arguments from probability to form a very different view. The chance that a plane system of stars, and still more a scroll of stars should be turned so directly towards the sun as to present to us the appearance of a straight or convoluted line or narrow stream of stars, is small indeed. The probability that several should be so situated may be regarded as evanescent.

Accepting these streams as having a roughly circular section, we are led to the conclusion that the Milky Way from which they extend has a similar section. In fact, as Sir John Herschel held these streams to be really planes or scrolls because (I assume) he assigned to the Milky Way a great lateral extension, so by inverting this argument I am led to believe that the Milky Way has not a great lateral extension (compared I mean with its thickness), because the streams extending from it have in all probability a section of roughly circular figure.

Other arguments there are that space will not permit me to dwell upon here, which point in the same direction.

Now, of course, if the Milky Way forms in reality a stream of stars *amidst the sidereal system*, the appearance which it presents upon the heavens might be expected to afford some information as to the shape of that stream, or at least of that portion which is cognizable by us. It must be admitted, however, that the problem of interpreting this wonderful stream is one of enormous difficulty. Perhaps it is one which men will never be able to accomplish in a perfectly satisfactory manner. It is only necessary to contemplate that marvellous maze of star-streams around Scorpio and its neighbourhood, and to read the account which Sir John Herschel gives (in his *Cape Observations*) of the telescopic aspect of this region, to feel how far we are at present from being able rightly to interpret the mysteries of the Galactic circle.

The bolder and more striking features of that circle may, however, be studied with a better hope of their being successfully interpreted. A theory which will explain the gap in Argo, the wide break of one stream in Ophiuchus, the varying brightness of the principal stream in different parts of its length, and other features of this kind, may reasonably be sought for.

I have endeavoured in the inner circle of the figure to indicate a spiral which seems to me to account for the most striking features of the Milky Way.

Following that spiral round from the part where the two loops approach each other, we have the following relations:—

First of all, the gap is explained by the fact that the two loops do not meet. Then remembering that the spiral is supposed not to lie in one plane, but (as the contorted figure of the Milky Way obviously suggests) to have been swayed out of that plane by varying attractive influences, we see that where the line of sight is directed tangentially to either loop, the Milky Way might be expected to have greater width than elsewhere. This explains the fan-shaped expansions on each side of the gap. Then on each side of these expansions we see the Milky Way double, which obviously corresponds to the relations exhibited by the two loops. Following the wider loop, we see that the double part of the Milky Way on this side extends nearly through a complete semicircular arc. The Coal-sack is explicable as due to the apparent intercrossing of the two contorted streams, which really are at different distances from the eye.[1] The break in the further branch seems readily explicable as due to the great distance of a portion of this branch. But here the theory derives a singular support from the actual relative brilliancy of different parts of the Milky Way in this neighbourhood. Every astronomer knows how strangely the light of the Milky Way varies in and near Cygnus. The branch which extends from the Northern Coal-sack towards Albireo is at first far the brightest, and then fades off so much that in Ophiuchus it is wholly lost. The other branch, on the contrary, gradually increases in brightness, until in Aquila, and, further on, in Sagittarius, it forms the brightest part of the whole Milky Way. Now this part which is so very bright corresponds to the part which my spiral brings so very near to the Sun.

Passing on to the termination of the second branch near Cygnus, it will be noticed how the spiral explains the strange extension of milky light from Cepheus towards the north pole.

Thence the stream is single, growing gradually fainter with increase of distance towards Canis Minor and Monoceros.

The spiral I have depicted seems so satisfactorily to account for several of the more striking features of the Milky Way as to suggest the idea that it probably corresponds somewhat closely to the real figure of that star-stream. I am sensible, however, that many peculiarities remain unexplained by, though they are by no means opposed to, my theory. It must be remembered that any objections founded on a presumed equality of stars throughout the Milky Way, or of a general uniformity of distribution throughout the spiral stream, do not require to be met; because at the very beginning of this inquiry I have abandoned such hypotheses as inconsistent with existing analogies.

For example, there may be parts of this Milky Way so constituted, that if we were to remove further and further from them, we should see them gradually assuming the form of irresolvable nebulosity. But there may be other parts which would never assume that appearance, let their distance be what it might—the distribution and magnitude of the component stars being such that the stars would vanish through effect of distance, before the distances apparently separating them became evanescent.

I may add, as a striking confirmation of a portion of these views, that among the lucid stars along the part of the Milky Way which lies nearest to the sun, according to my view, are those which have been actually found to be nearest to us.

It must be understood that I regard the Milky Way as simply the condensed part of a spiral of small stars, which has been swayed into its present figure by the influence of large stars—the lucid stars seen in the Milky Way. The myriads of small stars not lying in or near the Milky Way must yet belong to the same system, and in some instances seem to obey somewhat similar laws of aggregation. The nebulæ, so far as the evidence from probability extends, would appear to be groups formed from among those stars that have not fallen under the influence of the large stars which have brought the Milky Way spiral to its present figure. In the Magellanic clouds we see the action of processes which have tended to form spherical clusters of enormous dimensions, in which both forms of aggregation are met with.

Why, in different parts of the sidereal system different processes of aggregation should have taken place, we cannot yet distinctly see. But some of the striking discoveries which have recently been made by astronomers afford promise that light will soon be thrown on these perplexing questions.

P.S.—If my views respecting the Milky Way are correct, it obviously follows that there are parts of the Milky Way where traces of annual parallactic displacement might be looked for amongst *telescopic stars*. One instance of such motion would force us to modify all the views at present accepted respecting the sidereal system.—*Paper Read before the Royal Astronomical Society, Dec.* 10.

[1] In the large maps of the S. D. U. K. the Milky Way is depicted near Crux and Argo, as if the object of the draughtsman had been to support my theory. In Sir John Herschel's drawing, however, there are no such varieties of brilliancy.

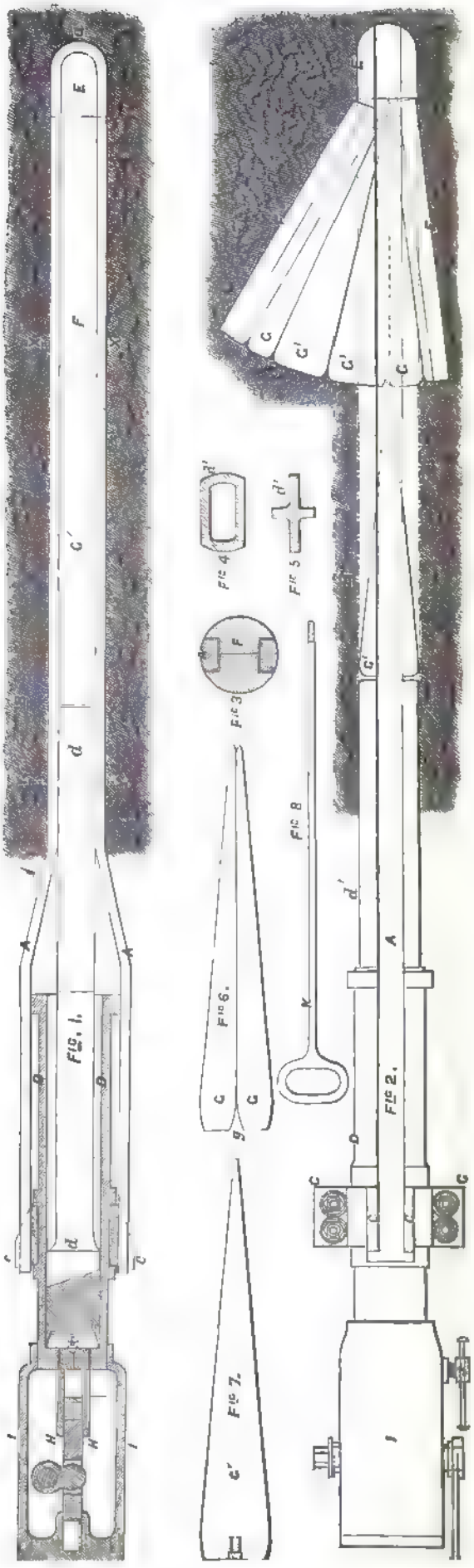
Cinchona.—The culture of the cinchona, or Peruvian bark, in St. Helena, is progressing satisfactorily. The plants, says the *Journal of the Society of Arts*, are all in excellent health, and have a fine green, vigorous appearance. There are now about 4,000 planted out, and it is thought a sufficient number can be obtained from them to stock the whole colony.

COLLIERY EXPLOSIONS PREVENTED BY A COAL-CUTTING MACHINE.

THE apparatus in the annexed figure, and which is devised to prevent colliery explosions, by providing for the removal of the coal from its bed without blasting, is the invention of Messrs. Jones and Bidder, and should have been noticed before now had not the blocks been accidentally mislaid. "Better late than never," we lay the following description from the *Mining Journal* before our readers :—

Messrs. Jones and Bidder's method consists in breaking down coal, slate, stone, and other minerals by means of apparatus wherein two or more wedges are caused to be driven consecutively by hydraulic or screw power between the surfaces of the substances to be broken down. The arrangement of apparatus for this purpose may be variously modified, but by preference they employ apparatus constructed as follows :—Two tension-bars or rods, either formed of two separate pieces or of one looped piece, are inserted into the hole cut in the coal or other substance, the outer ends of which bars are connected to the cylinder of a hydraulic ram or press, or to the framing, or screwed nut or boss carrying a screw spindle. Between the tension-bars, at their innermost end, is placed a clearance-box, and then two metal pressing-blocks, between which is afterwards forced first a single wedge by the action of the ram of the hydraulic press, or of the screw spindle; the ram or screw spindle is then withdrawn, and a second wedge is inserted, either between the one side of the first wedge and that of one of the pressing-blocks, or the first wedge may be made as a split wedge, and the second wedge be driven between the two parts thereof. If requisite, a third wedge may in like manner be driven in, and so on until a sufficient wedging action is obtained to effect the breaking down of the mass desired to be removed. The wedges and pressing-blocks may be formed either so as to cause the pressing-blocks while expanding to retain at first a position parallel to each other by making these with inner inclined surfaces, similar to the inclined surfaces of the wedges, or they may be arranged so as to form from the commencement a gradually increasing angle with each other. The wedges can pass beyond the pressing-blocks and into the clearance-box, which thus allows them to impart a greater lateral motion to the pressing-blocks than would be the case were the clearance-box not employed; it may, however, in some cases, be dispensed with when no great lateral motion is required. The ends of the tension-bars are by preference made detachable from the hydraulic press for introducing the wedges consecutively. When the apparatus is worked by hydraulic power, they prefer to construct the hydraulic press with the force-pump formed in one therewith, or fixed directly thereto, and it may be constructed either with a closed receptacle containing the requisite charge of water for working it, or the water may be supplied through a suction-pipe from a separate reservoir. This arrangement of apparatus may also be employed in some cases with effect with one wedge only, as by forming the pressing-blocks parallel—that is, without inclined surfaces corresponding to those of the wedge, as heretofore proposed—they are enabled to obtain an expansion equal to the entire thickness of the wedge, instead of equal only to a small portion thereof, as would otherwise be the case.

The advantages claimed for the improved apparatus, in addition to the absence of the noxious vapours in the mine and the danger resulting from the use of blasting-powder are—firstly, a great saving in the time employed in effecting the breaking down of the coal or other material, owing to the almost unlimited power which is available by their system, enabling them to break down at one operation far greater masses than can be effected by blasting; and, secondly, the avoidance of the great deterioration of the coal or other mineral which takes place when blasting-powder is used, owing to the large quantities of small fragments or "slack" which are pro-



ILLUSTRATING MR. PROCTOR'S NEW THEORY OF THE MILKY WAY. [See p. 68.

duced thereby. In the annexed diagrams, fig. 1 shows a part sectional side elevation of the apparatus; fig. 2 shows a plan of the same; and figs. 3 to 8 show details to an enlarged scale. Similar letters of reference indicate similar parts in each of the figures. A A are the tension-bars of wrought-iron, steel, or other metal capable of withstanding considerable tensional strain. These bars may either be formed of one piece bent round at *a* so as to form a loop, or they may be two separate bars connected together at *a*. These bars are inserted into a hole cut in the coal or other mineral B, to be broken down in the manner shown, the ends thereof, which project beyond the face of the mineral, being widened out for the reception of the cylinder D, of the hydraulic press between them, to which they are connected by T-heads formed at their extremities, being made to catch against lugs *c c*, on a collar C secured to the cylinder. Before the tension-bars are placed in the hole a clearance-box, E, is first placed between them at the extreme end of the loop, after which the two pressing blocks F F are inserted, the sectional form of which blocks is shown more clearly at the enlarged section of fig. 3; lastly, the two wedges, or the double or split wedge G G, shown enlarged at fig. 6, are introduced between the bars A A, so that their points just enter the small interstice between the pressing-blocks. The parts A, E, F, and G thus put together are then inserted into the hole in the material B, and the hydraulic press D is connected to the bars A A, as above described. The press D has a plunger *d* d^1, the front part, d^1, of which projects between the tension-bars, A A, as shown, and is formed either as shown in enlarged cross section at fig. 4, or as at fig. 5. To the back end of the press D is fixed the pump H, worked by means of the handle L, and inclosed in the reservoir I, containing the water required for working the press. The press being put in action the plunger forces the double wedge G forward between the pressing-blocks F, thereby forcing these asunder in an angular direction, and, consequently, causing them to exert a powerful bursting strain upon the sides of the hole. By forming the inner surfaces of the pressing blocks inclined, corresponding more or less with the taper of the wedge, this first expansion of the blocks may be effected in a more or less parallel direction instead of angular. The object of the clearance-box is to allow of the points of the wedges being driven past the inner ends of the pressing-blocks, so as to effect an increased expansion of these ends; where this is not required the clearance-box may be dispensed with. The double wedge G having been driven in to the required extent, the press is detached from the tension-bars A A, which is effected by first opening a passage of communication between the reservoir I and cylinder D by means of the screw *J*, so as to allow the water to flow from the latter back into the former, after which the press is pushed forward slightly, so as to release the T-heads of the tension-bars from the lugs *c*, whereupon the tension-bars are sprung open and the press removed. Another wedge G^1, shown enlarged at fig. 7, is now placed between the tension-bars A A, so that its point fits into the space *g* (fig. 6), formed between the two parts of the double wedge G. To facilitate the correct insertion of the wedge, for this purpose a handle K (fig. 8) is screwed into the rear end thereof, which is removed when the wedge is in position. The press is then again attached to the tension-bars, and the wedge G^1 is forced in between the two parts of the double wedge, thereby effecting a still greater expansion of the pressing-blocks; and in like manner, one or more other wedges may be consecutively forced in, as indicated at fig. 2, until the accumulated pressure thus produced is sufficient to break down the mass of coal or other material operated upon.

The invention can also be modified so as to employ screw

instead of hydraulic power. The arrangement of the tension-bars and pressing-blocks is similar to that used with hydraulic power; but the hydraulic press is replaced by a frame wherein is a slot with a wormwheel in it, fitting with a female screw thread upon a screw spindle, formed with flat upper and lower surfaces, and passing through correspondingly-formed holes in the bosses of the frame, so that it can move through but cannot turn in the latter. In gear with the wormwheel is the worm the spindle of which is carried by brackets on the frame, the ends of the spindle being formed to receive a ratchet lever for rotating the same. The ends of the tension-bars are formed with lugs, which catch behind keys bearing against other lugs formed on the frame, so that the frame is by this means connected to and disconnected from the frame by merely inserting the keys, and without having to spring open the tension-bars.

REVIEWS OF BOOKS.

Geology and Revelation; or, the Ancient History of the Earth considered in the Light of Geological Facts and Revealed Religion. With Illustrations. By the Rev. Gerald Molloy, D.D., Professor of Theology in the Royal College of St. Patrick, Maynooth. London: Longmans. 1870.

THERE is perhaps in the whole range of philosophical problems none which is at once more delusive to the general reader, more hopeless to the man of science, or more attractive to the theologian than the oft-attempted one of a reconciliation between Scripture as it is literally interpreted and the current doctrines of geology. Mantell, Miller, Buckland, Pye Smith, Hitchcock, and a host of others have all made an effort to establish some sort of explanation of the diametric opposition between the literally accepted account of creation given by Moses and that which evolves itself out of the study of the geologic record written in the "Great Stone Book of Nature." Nor is it too much to say that each and all have signally failed. They have built up an ingenious structure, which has crumbled down in the course of a few years, and has left the theology of the "word-and-letter" school more naked and defenceless than ever. Nothing daunted by these failures, the author of the present volume, a very distinguished and respected Roman Catholic divine, has come to the breach, and without rejecting Geology as absolutely unsound and unreliable, he attempts to show that many of her conclusions, in so far as they strike at Scriptural teaching, are, at best, baseless fabrics of a vision. But how, it will be asked, does he do this? By confessing that Scripture is misinterpreted, not by denying the facts of palæontology. Dr. Molloy's idea, by no means a novel one, is to the effect that the only dates which the Bible really deals with commence with the creation of Adam as the first man. The period which elapsed between Adam and Christ he settles, within round numbers, to be some few thousand years at the utmost. The eras before the creation of Adam may have represented any limitless period, so far as the Bible is concerned, and the author hypothetically regards them as corresponding tolerably exactly with the five first days.

Now, how is an argument of this kind to be dealt with. It is not novel, but how shall it be exposed? The difficulty is a great one. Perhaps the simplest reasoning is that which asks, Would any divine have accepted Dr. Molloy's idea a hundred years ago? and if not, is it not clear that the interpretation of the Scripture to-day may not be one whit nearer the truth than that which the learned and pious theologians of a century back would have sworn by at the stake? And, again, if this view of the seven days be correct, what becomes of that beautiful analogy which Moses laid down in the Sabbath commandment, "for in six days the Lord made heaven and earth, and all that in them is, and rested the seventh day"? Really, we do not see that Dr. Molloy's "reconciliation" is anything more than one of a number of ingenious hypotheses which—Scriptural phrase being made elastic for the purpose—may be framed to meet the ends of Geology.

These, however, are not the most serious objections to the author's well-intentioned effort to exorcise Scepticism. There is a flaw far deeper in Dr. Molloy's argument, and one which indeed renders his reasoning absolutely without foundation. Dr. Molloy has worked up the elements of Geology with considerable ability, and has produced a very readable, well-written work; but he has ignored all the great leading facts in that science which is the handmaid of Geology, Prehistoric Archæology. He takes no cognizance of the fact that even if we accept the view, that the Bible tells us of the first creation of man, and assures us that the period between that event and the coming of Christ is within 6,000 years, there is still terrible discrepancy between the Bible so interpreted and the clearly established truths in regard to the antiquity of man. What is the force of Dr. Molloy's labours to reconcile Scripture and Science if he admits that the one sets down the age of the human race at something certainly under 10,000 years, and that the other alleges with equal distinctness that 200,000 years have expired since man's appearance on the globe? As the Poet Laureate expresses it,—

"So many a million of ages was spent in the framing of man."

It appears to us that all the author's labours are vain, and that he has left the difficulty practically where he took it up. If theologists are satisfied, as they of course are, that whatever the records of Geology, the records of Scripture must always be true, it is, we think, a pity to make Geology a sort of Procrustean bed on which the Bible is either drawn out or cut down to the required limit by some writer with more of faith than wisdom. For this reason, then, we disapprove of books like the present. Of one thing we are convinced. Treatises like that of Dr. Molloy, in which the Bible is made to tell the required story, and in which so much of scientific truth as is demanded is told and no more, are the stepping-stones of Scepticism, by which the young mind passes across the stream of doubt into the region of unequivocal Atheism. If reverend and well-disposed writers like the author of the present work could only see the mischief they are doing to their own cause, we feel confident they would stay their hands. Such books may allay the temporary qualms of the unthinking, who really require no assurance, but to the young, earnest, thoughtful mind they give the impression that the foundations of theology must be fearfully insecure, when divines like Dr. Molloy are forced to twist and wring and turn and distort the old interpretation of the Bible, in order to meet the demands of modern discovery.

This work is of a school that we had thought—nay, almost hoped—was extinct; but it is, nevertheless, not without interest; and, however imperfect it may be, we must not let its defects mar our opinion of the great zeal and honest wishes of the author. Dr. Molloy has made a good effort, and he has failed; but the fault is none of his. His book has been badly printed, and is defaced by various typographical errors. In one chapter the sea of the Chalk Period is throughout spoken of as the *Crustaceous* Sea; and this is only one sample of the errata.

The Earth's History, or First Lessons in Geology. By D. T. Ansted, M.A., F.R.S. London: Allen. 1869.

A CONTEMPORARY, in a captious desire to redeem its waning reputation as a Scientific Journal, has thought fit to quarrel with the author of this little school-book because he was honest enough to admit that certain facts in the distribution of animal life were difficult of explanation. We dissent from such an idea. It is far better to admit, especially to the young, that certain phenomena are as yet unexplained, than to give them an explanation which is inexact, or to leave the matter altogether unreferred to.

This little book of Professor Ansted's is very modest; it is addressed to schools principally, and is really a good little volume in its way, being condensed, very clear and well written, occasionally illustrated, covering only 200 pages, and, withal, sold at an absurdly low price. It contains nothing new, of course. It is simply a summary of the leading facts and principles in geology and palæontology intended for the use of pupils in our large schools. It seems to us very well executed, and we can only say we wish that all, even of our scientific friends, were conversant with everything that it teaches. Messrs. Allen are to be congratulated on their enterprise in issuing so cheap a series of scientific manuals for the young.

The British Journal Photographic Almanac for 1870. Edited by J. T. Taylor. London: Greenwood.

The Year-Book of Photography and Photographic News Almanac for 1870. Edited by G. Wharton Simpson, M.A., F.S.A. London: Piper & Carter.

THE words of the old song, "How happy could I be with either," recur to us as we glance at these excellent photographic year-books. Each contains an almanac and a compilation of articles and extracts which must be most useful to both professional and amateur photograpers. Each is edited by a gentleman well known in the world of photography for his scientific and literary reputation. Both are so good that we cannot choose between them, but must leave our photographic readers to draw their own conclusions as to their respective merits.

BIBLIOGRAPHY.

GERMAN.

[Owing to some annoying anomaly in the postal arrangements, our German parcel, containing the list of German books and reports of Academies, has not, up to the time of going to press, arrived. Inquiry of the authorities throws no light on the matter.—Ed. *S. O.*]

FRENCH.

Analyse des Eaux minérales acidules-alcalines-ferrugineuse du Boulu. Par M. A. Béchamp. Montpellier. Boehm et Fils.

Discussion sur la Mortalité des Nourrissons. Par M. F. Boudet. Paris. Malteste.

Dosage du Carbone dans la Fonte, le Fer et l'Acier. Par M. Boussingault. Paris. Gauthier-Villars.

Du Crétinisme et du Goître endemique. Par M. C. J. Berger. Bourg. Milliet-Bottier.

Du Traitement du Rhumatisme articulaire chronique, primitif, généralisé ou progressif par les Courants continus constants. Par M. J. Chéron. Paris. Delahaye.

Essai sur certaines Modifications de la Nutrition pendant la Grossesse. Par M. E. Barlemont. Paris. Cocooz.

Essai sur la Géologie de la Palestine et des Contrées avoisinantes telle que l'Egypte et l'Arabie, comprenant les observations recueillies dans le cours de l'Expédition du duc de Luynes à la mer Morte. Par M. L. Lartet. Première Partie. Paris. Martinet.

Etude généalogique sur les Aliénés héréditaires. Par M. G. Doutrehente. Paris. Donnaud.

Etude médico-légale sur Troppmann. Par le Docteur A. Bertrand. 1e Edition. Paris. Alcan-Lèvy.

Etude nouvelle sur l'Univers et ses Habitants. Par M. E. Delahaye. Paris. Tous les Libraires.

Manuel de Pathologie et de Clinique chirurgicale. Par M. J. A. Fort. Paris. Delahaye.

Précis Analyse Chimique qualitative. Par MM. Gerhardt et Chancel. 2e Edition. Par M. Chancel. Paris. Victor Masson.

Simples Notions de Physique et d'Histoire naturelle. Par M. L. de Jussieu. Nouvelle Edition. Paris. Delagrave.

Sur la Distribution géographique des Fougères du Mexique. Par M. E. Fournier. Paris. Martinet.

Un Mot sur le Vin de Bordeaux. Ses Négociants. Suivi d'un tableau indiquant la quantité d'alcool pur contenue dans les vins du département de la Gironde. Par M. H. Kehrig. Bordeaux. Chaynes.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

The Value of Negative Evidence in Geology.—*From* An Old Stager.

Sir,—I observe in your last number a letter from a modest "Young Beginner," which touches upon many points in geology, on which there is much popular misconception. Allow me very briefly, as an "Old Stager," to give a few words in reply.

All testimony of rocks that can be regarded as worthy of the smallest value is positive, not negative. The absence of fossils of a certain kind, assumed because such fossils have not yet been determined, is no proof whatever that the animals that would have left such fossils did not exist. I would ask, in reply to your correspondent, What remains of quadrupeds or birds would probably be found in the bed of any great existing ocean if elevated? What remains of such animals would be found in any part of the southern hemisphere (where there are numerous large islands with a very scanty fauna of vertebrata), if elevation were now to take place, and such areas as those occupied by palæozoic formations in the northern hemisphere were laid bare? All we know of the palæozoic rocks is that the coal-measures, although certainly formed near land, were as certainly deposited near such lands as, judging by existing analogies, would contain little of vertebrate life at all, and very little indeed of mammalian life. Witness the vast accumulations of vegetable life in the northern part of South America, almost to the exclusion of such vertebrata as would leave fossil remains in any proportion to the magnitude of the deposit. All the other palæozoic rocks appear to have been deposited under conditions in the very highest degree unfavourable to the preservation of any other vertebral remains than fishes. Even fishes' remains would rarely be found in deposits made in deep water, and hitherto not a fragment of vertebrata has been dredged from the open Atlantic, notwithstanding the vast amount of such life in the ocean above.

There is really no gradual dying out of life in the older rocks. All that is reasonable to assume is that these old rocks were formed in waters that contained but little of the higher forms, but this is by no means inconsistent with the existence of such forms elsewhere. This is what geology, or rather palæontology, really shows. All that your correspondent considers shown is only inferred, not from evidence, but from the absence of evidence.

Assertions in geology are easy, especially when made from imperfect evidence. Proof in geology is difficult, because it can only be obtained from complete evidence. In no science is patience more needed, and in none are premature conclusions more likely to be upset. Such terms as the "age of reptiles" ought not to be made use of, and as to the age of coal geologists know well that the term is an absurdity as usually applied. Coal exists of all ages, from the oldest to the newest. Perhaps reptiles did so too.

It is true that eminent geologists have endeavoured to obtain time and limits for the deposit of certain rocks. They have done so, I suppose, rather in the hope of ultimately coming to some conclusion than of really dogmatizing in the present state of science. The very fact that the limits are given so widely is a proof that they are not regarded as of much value. Some of us regret that the attempt has been made.

Your correspondent and readers may rest satisfied that the time has not yet come for absolute conclusions on the subjects alluded to, and that there is still much to do in the accumulations of facts.

An Old Stager.

The Earth not a Globe!!—*From* Mr. R. A. Proctor.

Sir,—It may amuse your readers to hear that your jocular correspondent, Mr. John Hampden, has promised to take 500 copies of my new Star-Atlas, if I will but demonstrate that the earth is a globe. With your permission, I will forward my reply to this munificent offer through your columns. Yours truly,

Richard A. Proctor.

To Mr. John Hampden, Swindon.

Dear Sir,—My friend, Mr. Brothers, has forwarded me your amusing letter. You have worked hard at your little joke, and deserve a reply. I have not the least notion of trying to demonstrate to you that the earth is a globe—a difficult task I should say; but I have a hint or two to offer about your forthcoming work.

The first edition was not bad; Professor De Morgan made us all enjoy it immensely at the Royal Astronomical Society. But while

well calculated to amuse, it wanted pruning. Now, if you will permit me, I will suggest a few of the most needed excisions.

I think I would drop the canal experiment. In the picture, Parallax looks insane, but that is not my objection. You know the experiment is so easily tried, and that spoils the whole thing.

Perhaps, too, it would be as well if you omitted the air-gun experiment. To say that out of forty balls fired straight up, two fell back into the muzzle, is like saying one has tossed "heads" fifty times running. [*Mem.*—Above all things do not let Mr. Rowbotham's veracity be suspected.]

Then the extracts should be removed altogether. Suppose some one looked them out, where would your case be? For example, Parallax says a certain captain saw the pole-star from the latitude of Capricorn, and he quotes the *Times* to that effect. But one has only to turn to the particular number named, to see that the captain's ship was in the latitude of *Cancer* at the time. [*Happy Thought.*—If you do not omit the story, give a wrong date.] Again, there is the bottle-story from Ross's *Antarctic Voyages*. You may depend on it some one will look this up, and find that a little joke has been played upon them. It is much the same with every other extract in the book, so far as my memory serves. Either omit them, or slip in a few wrong references. It is easily managed.

Do you think the "level" argument a safe one? It seems to me our friend Mr. Rowbotham over-estimated the credulity of the general reader. He knows best, however, having pretty extensively gauged that quality.

I should omit the lighthouse matters. Most people know something about the air's refractive powers. So also the theodolite story; it is *rather* too thinly covered.

Can you get any one to believe that Auckland and Wellington, N. Z., lie in about the same latitude south as London north? The joke seems almost too good. (Between you and me, one might as well say Madrid and London are in the same latitude.)

You may urge that when these matters are left out; nothing will remain in "the new scientific work." That, however, is a detail.

Perhaps, after all, the old Eton rule is sound; you know how it runs,—"Tell a banger—tell a good 'un, and stick to it." If you should stick to your own, *à fortiori*, you should stick to your friend's.

Some one who heard Parallax lecture said the sun ought to vary in size as much as a crown differs from a fourpenny-piece, if his theory were true. This is so; but just throw in as a corrective a few words about refraction (or diffraction if you like), or put down observed appearances as an optical delusion.

If my memory serves me there was a good deal of what censorious people call clap-trap in Parallax's book—about religion, you know. This is well; keep that part in, whatever you do. In fact, you might add something more in the same style. The sort of readers you are likely to have will not see through it. Besides, your book would not have a natural look without something of the sort.

Garnish with "oh's! ah's!" and interjections of all kinds *ad libitum*.

Yours faithfully,

Jan. 11. R. A. Proctor.

An Educational Library of Reference.—*From* A Governess.

Sir,—Being a teacher, and a constant reader in the Educational Library of the South Kensington Museum, I cannot do better than recommend the lady referred to in "M. A. (Camb.)'s" letter to pay it a visit, where, by virtue of her profession, she will have free access to the educational works of all the principal English publishers, and some of the foreign firms. This library is an inexhaustible treasure to the teacher, and the pleasure of a visit is considerably enhanced by the civility and attention of the officials.

A Governess.

Eunuchs among Animals.—*From* E. T.

Sir,—I shall be glad if you, or any of your correspondents, can give me an opinion as to the truth of the following reported facts.

A civilian in India writes me that he has heard from eye-witnesses that a large proportion of the monkeys which are seen in the groves round the temples are castrated. One of his informants, an official in Gujerat, says this is much rarer among the large white-whiskered monkey, than among the small ones.

Another informant tells him that the same custom is seen among the wild donkeys of the Runn of Cutch.

My correspondent remarks that the jealousy among tigers leads the old male to kill all the young males of his own species that he comes across, and that the dam to preserve her cubs therefore separates from the, according to our ideas, unnatural father. He says the same thing is true of the wild hogs, and that it is common for sportsmen to find young tigers and hogs butchered in the jungle, but that young *females* are never so found.

"Of course it is the strongest of the young males which escape uninjured, and those which have good strong mothers to protect them, have also a better chance of escape; so that, in the long run, the males which survive, are the healthiest offspring of the strongest dams."

But he is justly astonished at the way the monkeys take to render the young males harmless.

On the latter point I must say I should like to have further testimonies.

We are evidently indebted to the influence of Darwin's remarkable book, for these observations.

I am, Sir, yours truly,

Torquay. E. T.

Which is the Second Largest River in the World?—*From* Amnis.

Sir,—Could you kindly inform me through the medium of Scientific Opinion which is the second largest river in the world? The Amazon is almost universally admitted to be the largest. The second place has been, I believe, claimed for the Rio de la Plata, Orinoco, and the Bramahpootra of the Old World, which is far superior to the Indus, Ganges, Chinese, and Russian rivers. The mysterious Zaire, or Congo, of South Africa, brings down a vast body of water, and very likely has a much longer course than has yet been ascertained.

On very strange grounds some geographical writers have claimed for the St. Lawrence the very headship of rivers, by making it rise in a small stream at the head of Lake Superior, and taking all the five great inland seas as expansions of the St. Lawrence. The Mississippi and Missouri, though rivalling the Amazon in length, are contemptible when compared with the Parana, Paraguay, Uruguay (Plata heads), or Orinoco in breadth, the force of current, and depth.

What is the best test of a river's size?

Unquestionably this:—Suppose the water to be taken out of the dyke of the river, and measure the cubical contents of such dyke. But still, between rivers so comparable as the Parana and Orinoco in this respect, we would give the palm to that river which brings down the greatest annual amount of water to the ocean. But no one would think of putting the Rhone before the Danube, though I should think its annual discharge exceeded that of the Danube.

It is somewhat curious; though there is, as far as I know, no concord of opinion as to the second river as there is as to the first.

Jan. 11. Amnis.

An Unknown Mandible.—*From* Mr. T. P. Barkas.

Sir,—There has recently come into my possession, obtained from the Northumberland Low Main coal-shale, a jaw, which to me is unique. It is unlike any fish or reptile jaw in my possession, and much unlike any that I have seen in Northumberland or elsewhere.

It is lying upon a slab of shale which measures 5 in. by 4, and the jaw before deposition has been broken into two almost equal parts; the two fragments lie near to each other upon precisely the same plane. The teeth, forms of the fragments and external markings, very closely resemble each other, and the two fragments constitute the greater part of the left mandible of a fish or reptile. The length of the two fragments when united is 4 in., the depth of the mandible near the point of symphysis is $\frac{3}{4}$ in.; it gradually widens towards the articular extremity, near which it is $\frac{1}{4}$ in. deep; the thickness of the mandible at $\frac{1}{4}$ in. below the alveolar border is $\frac{5}{16}$ in., and its thickness at the lower margin is $\frac{1}{2}$ in. The teeth are arranged in a continuous series of uniform size along the alveolar border, a strong, bold ridge is continued along the entire jaw, and the teeth are placed $\frac{1}{8}$ in. behind the face of the projecting ridge. The external surface of the mandible is covered with minute, well-defined rugose markings, having the appearance of inosculating ridges, and besides the pits and depressions formed by the frequent union of the ridges the jaw is covered with more minute pittings, that require the use of a highly magnifying hand lens to render them distinctly visisible. The teeth are $\frac{1}{12}$ in. long; they are stout, compact, and strong, and are placed along the entire jaw at a uniform distance from each other of $\frac{1}{12}$ in. Within a space of one inch there are ten teeth, and the mandible, which is 4 in. long, contains forty teeth of uniform size, placed at uniform distances from each other. The teeth, which are smooth, black, and glistening, are free from longitudinal striæ except at the roots, where there are slight indications of a plicated structure. The inner surface of the jaw, which at one part of the specimen is well exposed, is on its lower and upper portions marked with bold longitudinal lines. The articular extremity of the jaw is absent, and I infer from the general appearance of that portion in my possession that one inch of the mandible has been lost, and that the total length of the jaw has been 5 in.

I am unable to say whether the jaw is reptilian or icthyic. In form and in external markings, it somewhat resembles a very fine lower jaw of *Pteroplax cornuta*, now in my possession, but the teeth differ totally from those of that coal-measure reptile. The rugose markings on the external surface, somewhat resemble those on Rhizodopsis, but the teeth and form of the mandible differ extremely from those of that well-known fish. The mandible most closely resembles the form

of the maxilla of Megalichthys, and the rugose structure somewhat resembles the markings on the jaws and scales of Megalichthys when they have been stripped of their external coat of enamel. Those are the facts, so far as regards resemblances, but the differences are so manifest that any person acquainted with carboniferous palæontology would be able to recognize the distinctions at a glance. On the slab containing the mandible there are a few scales of Cœlacanthus, and a rib, apparently, of Ctenodus, but to neither of these fish can the mandible be ascribed. For the present I leave the question of its identification open, and hope that some additional remains may eventually enable me to interpret a fossil which, although beautifully exposed and well defined, presents to me, as yet, an unsolved problem.[1]

I am yours obediently,

Newcastle-on-Tyne. T. P. BARKAS, F.G.S.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, JANUARY 13TH.—The following paper was read:—"On the Mineral Constituents of Meteorites," by Nevil Story-Maskelyne, M.A., Professor of Mineralogy in the University of Oxford, and Keeper of the Mineral Department, British Museum; communicated by Professor H. J. Stephen Smith, F.R.S.

1. *The Application of the Microscope to the Investigation of Meteorites.*—The difficulties in the way of the complete investigation of a meteorite resemble those we meet with in terrestrial rocks. In both the ingredient minerals are minute; and are often, especially in the case of the aërolitic rock, very imperfectly crystallized. Moreover, the methods for separating them, whether mechanically or chemically, are very incomplete. With a view to obtain some more satisfactory means of dealing with these aggregates of mixed and minute minerals, I sought the aid of the microscope, by having in the first place sections of small fragments cut from the meteorites so as to be transparent.

One may learn, by a study and comparison of such sections, something concerning the changes that a meteorite has passed through; for one soon discovers that it has had a history, of which some of the facts are written in legible characters on the meteorite itself. And one finds that it is not difficult roughly to classify meteorites according to the varieties of their structure. In this way one recognizes constantly recurring minerals; but the method affords no means of determining what they are. Even the employment of polarized light, so invaluable where a crystal is examined by it, of which the crystallographic orientation is at all known, fails, except in rare cases, to be a certain guide to even the system to which such minute crystals belong. It was found that the only satisfactory way of dealing with the problem was by employing the microscope chiefly as a means of selecting and assorting out of the bruised *débris* of a part of the meteorite the various minerals that compose it, and then investigating each separately by means of the goniometer and by analysis; and finally recurring to the microscopic sections to identify and recognize the minerals so investigated. The present memoir deals with the former part of this inquiry. Obviously the amount of each mineral thus determined, after great care and search, can only be extremely small, as only very small amounts of a meteorite can be spared for the purpose; notwithstanding that as large a surface as possible of its material requires to be searched over for instances of any one of the minerals occurring in a less than usually incomplete form. On this account one has to operate with the greatest caution in performing the analysis of such minerals; and the desirability of determining the silica with more precision than usually is the case in operations on such minute quantities of a silicate suggested to me the process which, after several experiments in perfecting it, assumed the following form.

II. *On the Method of Analyzing Silicates that do not gelatinize with Hydrogen Chloride.*—The process is conducted in an apparatus of the following construction. A platinum retort, 30 cub. centims. in capacity, is fitted with a tubulated stopper of the same material, which reaches nearly to the bottom; a small tube, entering the vertical tube of the stopper at an angle above the neck of the retort, conveys hydrogen to its interior. The vertical tube can be closed either by a stopper of platinum or by a funnel of that metal, stopped in like manner at the top, and having a fine orifice at its lower extremity.

To the side of the retort, just below its neck, a straight delivery-tube is fixed, which in its turn fits into another platinum tube that, after taking a curve into a vertical position, is enlarged into a cylinder which passes a considerable distance down a test-tube. The latter, into which the delivery-tube is fitted with a cork, holds 7·5 cub. centims., or 6·6 grammes of strong ammonia of the specific gravity 0·88. The gas-delivery tube inserted in the side of this receiver dips into some more ammonia in a second test-tube.

The pounded mineral, from 0·2 to 0·5 gramme in quantity, and a small platinum ball, are placed in the retort, and the stopper luted to it with guttapercha, and cemented air-tight in its place with caoutchouc and guttapercha varnish. The funnel, filled with perfectly pure hydrogen fluoride, is now introduced into the tubulure of the stopper, the tap opened, and the acid allowed to run down into the retort. This acid contains about 32 per cent. of absolute hydrogen fluoride—that is to say, a funnel of this reagent contains 1·12 gramme of acid, capable of rendering gaseous 0·84 gramme of silica, and of neutralizing 0·95 gramme of ammonia. The funnel is now replaced by a little platinum stopper, and the orifice secured air-tight with guttapercha varnish. Pure hydrogen is then allowed slowly to traverse the entire apparatus, the retort is placed in a water-bath at 100° C. for two hours, and occasionally slightly shaken to set the ball rotating. During the operation a trace only of silicium difluoride passes over.

The retort is next transferred to a paraffin-bath, and the temperature is cautiously raised. At first hydrogen fluoride passes over, and at this point of the process the flow of hydrogen requires some attention to prevent regurgitation of the ammonia. At about 132° C., in the case of the silicates mentioned in this memoir, the silica first becomes visible in fine flocks in the ammonia of the receiver, and in another minute the whole is cloudy.

In eight minutes the rise of the thermometer to 145° C. has brought over so much difluoride that the contents of the tube are semi-solid, and nearly the whole of it has passed over. The temperature is then raised to 150° C., and the retort allowed to cool. The process is next repeated with a fresh charge of acid and ammonia. If no more than 0·2 gramme of silicate be taken twice charging of the retort is sufficient; but with 0·5 gramme three or four repetitions of the process are required. In short, the operation is continued with fresh reagents till no flock of silica forms in the receiver. Finally, 0·75 cub. centim. of sulphuric acid is introduced into the retort, and the temperature again raised to 160° C., the stream of hydrogen being continued as before.

The several ammoniacal charges are poured into a platinum dish, together with the washings of the delivery-tube and the two test-tubes, and slowly evaporated in a water-bath, with continued stirring.

At a point in the evaporation just before the solution becomes neutral and the ammonium fluoride begins to turn acid, the entire silica in the dish will have been dissolved by the fluoride. The process is gradual, but the moment when the solution is complete is easily determined. Then, the dish being removed, potassic chloride is added in slight excess, together with absolute alcohol equal in volume to the contents of the platinum vessel. Potassium fluosilicate precipitates, which, after the lapse of twenty-four hours, is filtered, weighed with a mixture of equal volumes of absolute alcohol and water, dried, and washed. The results are accurate. In the retort are the bases in the form of sulphates, the treatment of which calls for no further remark.

III. *The Busti Aërolite of* 1852.—This meteorite fell on the 2nd of December, 1852, about six miles south of Busti, a station halfway between Goruckpoor and Fyzabad in India, and nearly in lat. 26° 45′ N. and long. 82° 42′ E. For an account of the circumstances attending its fall I am indebted to Mr. George Osborne, at that time resident at Busti, and who presented this stone (the only specimen of the fall that he was able to procure) to the East India Company. Mr. Osborne states that the fall took place at ten minutes past ten in the morning, and was attended by an explosion louder than a thunder-clap, and lasting from three to five minutes. At Goruckpoor the report appeared to approach in a direction from N.N.W.; at Busti the sound seemed to come from the zenith, and proceed in a somewhat easterly course.

The explosion that shattered the meteorite must have occurred soon after its passing the longitude of Goruckpoor. There was no cloud in the sky at the time. The stone, which weighed about 3 lb, was presented to the collection at the British Museum by the Secretary of State for India.

The Busti aërolite bears a great resemblance to the stone that fell on the 25th of March, 1843, at Bishopsville, South Carolina, U.S. A crust, coating the larger part of the stone, was of a dark yellowish brown, with a few yellowish white porphyritic-looking patches at its flat end, whilst a yellowish enamel, mingled with dark grey, covered a hollow portion on one side of the stone.

It is difficult to refer these markings to the minerals underlying them, a similar crust covering both the augite and enstatite of the meteorite. They are probably due to the alterative action of the oxidized products of the nickeliferous iron on the silicates in a state

[1] If it were not exceeding our task as Editor, we would express a hope that Mr. Barkas would prolong his researches on each specimen. He is always telling us of new discoveries, but he seldom tells us anything completely. What about the mammalian jaw?—ED. *S. O.*

of fusion during the rapid passage of the stone through the atmosphere.

The meteorite consists for the most part of the mineral enstatite; at one end, however, was imbedded a number of small chestnut-brown spherules, in which again a lens enabled me to detect minute octahedral crystals, having the lustre and colour of gold.

These two minerals seem scarcely to have been affected by the heat that fused the silicates which surround and encrust them.

IV. *Sulphide of Calcium* (Oldhamite).—This mineral occurs in the Busti aërolite, and sparsely in that which fell at Bishopsville, imbedded in augite, or enstatite, or both of them. It has a pale chestnut-brown colour, and forms small, nearly round spherules, whose outer surface is generally coated with calcium sulphate. It cleaves with equal facility in three directions, which give normal angles, averaging 89° 57′, and are no doubt really 90°. Its system, therefore, is cubic; indeed in polarized light it is seen to be devoid of double refraction. Its specific gravity is 2·58, and its hardness 3·5 to 4. With boiling water it yields calcium, polysulphides, and in acids it easily dissolves with evolution of hydrogen sulphide. Chemical analyses indicated the following as its composition:—

		I.		II.
Oldhamite	Calcium monosulphide	89·369	.....	90·244
	Magnesium monosulphide ...	3·246	.....	3·264
Gypsum		3·951	.....	4·189
Calcium carbonate		3·434	.....	.....
Troilite		.....	.....	2·303
		100·000		100·000

The presence of such a sulphide in a meteorite shows that the conditions under which the ingredients of the rock took their present form are unlike those met with in our globe. Water and oxygen must have alike been absent. The existence of iron in a state of minute division, as often found in meteorites, leads to a similar conclusion. But if we bear in mind the conditions necessary for the formation of pure calcium sulphide, the evidence imported into this inquiry by the Busti aërolite seems further to point to the presence of a reducing agent during the formation of its constituent minerals; whilst the crystalline structure of the Oldhamite and of the Osbornite must have certainly been the result of fusion at an enormous temperature. The detection of hydrogen in meteoric iron by Professor Graham tends to confirm the probability of the presence of such a reducing agent.

V. *Osbornite.*—The golden-yellow microscopic octahedra imbedded in the Oldhamite were furnished by the analyses of that mineral to the amount of only 0·0028 gramme, and though upwards of 150 in number, were capable of being measured by the goniometer.

This microscopic mineral I wish to name Osbornite, in honour of Mr. Osborne, and in commemoration of the important service that gentleman rendered to science in preserving and transmitting to London in its entirety the stone which his zeal saved at the time of its fall.

That the octahedra of Osbornite are regular was proved by angles of even such microscopic crystals giving measurements over the edges and solid angles that accorded within 3′ with those of the regular octahedron.

The crystals are brittle, and their powder retains the beautiful yellow colour of the surface, which is therefore intrinsic, and not a tarnish. The amount of them available for analysis being so minute, their chemical examination was attended with much difficulty. Boiled for a long time in the strongest hydrogen chloride, they were unchanged, and hydrogen fluoride was apparently without action on them. They passed unscathed through a fusion with potassio-sodium carbonate. When heated on a splinter of porcelain in a current of dry chlorine, the crystals glowed for a few seconds, lost their metallic lustre, and became of a honey-yellow colour, while a white sublimate formed on the walls of the tube. Exposed to the air, the altered crystals deliquesced, and assumed a pasty consistence; in water they dissolved partially, forming an alkaline solution, in which ammonium oxalate produced a precipitate. The insoluble portion was taken up for the most part by hydrogen chloride, and its solution gave a decided precipitate with the above reagent. The water through which the chlorine was allowed to escape, and the sublimate in the tube, after treatment with hydrogen chloride, were taken together, and found on examination to give a white precipitate with barium chloride, the filtrate from which, after the excess of barium had been removed, furnished with ammonia a precipitate resembling alumina, which, however, was insoluble in potash, and was thrown down from slightly acid solutions with sodium, hyposulphite, and potassium sulphate. It was examined for titanic acid by means of magnesium wire in a slightly acid solution, but with a negative result. The only alternative left was to conclude that the substance which exhibited this deportment was either titanium or zirconium, and that the gold-like crystals were a combination of this element with calcium (perhaps a little iron) and sulphur in some remarkably stable form. That this mineral should be a compound of the sulphides of these metals merely is scarcely conceivable when its power to withstand the action of acids is considered; and it seems probable that its composition, if it could be quantitatively analyzed, would be found to be that of a compound of titanium or of zirconium and calcium of the obscure kind that is known as an oxysulphide.

Mr. Sorby, who has made the zirconium and titanium group of metals the subject of special study, formed a microscopic borax bead, into which he introduced some of the oxide obtained from the Osbornite. He found it to behave as titanic acid.

The occurrence of Osbornite, occasionally in the augite presently to be described, and the fact of the latter mineral lying chiefly in that part of the meteorite where the Osbornite is found, suggested the possibility of the presence of this metal of the zirconium group in the augite itself,—an assumption confirmed by experiment. The dichroism of this augite is strongly marked, especially through the face 0 1 0, which in one position exhibits a tint resembling the blue anatase of Brazil, due apparently to minute scales permeating the crystal, and visible only in the microscope. These scales may possibly be the Osbornite sufficiently thin to be transparent, and may be the cause of the beautiful golden metallic reflection which characterizes the face 1 0 0 of the augite.

VI. *The Augitic Constituent of the Busti Aërolite.*—Associated with the spherules of Oldhamite that have been described as occurring in a nodule of this aërolite, and less plentifully distributed through the rest of its mass, is the silicate already alluded to as a variety of augite, and as containing traces of titanium or zirconium oxide. This silicate occurs in crystalline grains of a pale violet-grey colour, intimately mixed with another silicate presently to be described. When isolated, these grains present a few crystal faces, among which one as a cleavage-plane is prominent. So imperfect are the rest, that they furnished reliable measurements only with extreme difficulty. These determinations, however, together with its optical characters, proved that the mineral belongs to the oblique system. The measurements gave the following approximate values:—

			Angles found.	Angles of diopside.
0 0 1	.....	1 0 0	About 75° 30′	73° 59′
0 0 1	.....	1 1 0	About 81°	79° 29′
1 1 0	.....	1 0 0	45° 54′ to 47° 26′	46° 27′
1 1 $\bar{0}$	.....	$\bar{1}$ 1 0	85° 8′ to 86° 20′	87° 5′
1 0 0	.....	1 1 1 (?) ...	53° 25′ to 54° 15′	53° 50′
0 0 1	.....	$\bar{1}$ 1 0	100° 8′	100° 57′

The plane containing the optic axis is perpendicular to the edge 1 0 0, 0 0 1, and the optical character in the centre of the field is negative on looking down the second mean line, which makes angles about 20° 45′ and 52° 30′ with the normals to the faces 0 0 1 and 1 0 0 respectively. Two analyses of this mineral by the method described gave the following results:—

	I.		II.	Mean oxygen ratios.
Silicic acid	55·389	.....	55·594	.... 29·928
Magnesia	23·621	.....	23·036	..... 9·331
Lime	20·02	.....	19·942	..... 5·709
Iron oxide	0·78	.....	0·309	
Soda	0·554	.....	[0·554]	
Lithia.....	trace	.....	[trace]	
	100·364		99·435	

Viewed as a magnesium calcium silicate, the percentage composition becomes—

Silicic acid	56·165	.....	56·604
Magnesia	23·612	.....	23·585
Lime	20·223	.....	19·811
	100·000		100·000

The second column gives the percentage composition according with the formula

$$(\tfrac{2}{3}\ \mathrm{Mg},\ \tfrac{1}{3}\ \mathrm{Ca})\ \mathrm{O},\ \mathrm{SiO_2}.$$

Such a formula does not accord with those of the ordinary varieties of augite, in which calcium is usually present in at least as high a ratio in equivalents as the magnesium. A deduction, however, of a certain amount of purely magnesian enstatite corresponding in chemical type to the augite has to be made by reason of the presence of the white mineral intercalated in layers along a direction parallel to the plane 0 0 1, and sometimes to a second plane. This white mineral is, there can be no doubt, the mineral next to be described, and its presence would modify the apparent formula of the augite as derived from analysis, increasing the magnesia.

The trace of the titanoid element in this mineral is included with the iron oxide in the above analyses.

(To be continued.)

GEOLOGICAL SOCIETY OF LONDON.

JANUARY 12TH.—Professor Huxley, LL.D., F.R.S., president, in the chair. John Aitken, Esq., J.P., of Bacup, president of the Manchester Geological Society; Edward Allen, Esq., 19, St. Saviourgate, York; Clement Cadle, Esq., Gloucester; Arthur Wyatt Edgell, Esq., of Lympstone, Exeter; Charles F. Leaf, Esq., F.L.S., Old Change, and Harrow; and Samuel Joseph Smith, Esq., 29, Park-road, New Wandsworth, were elected fellows of the society. Professor Otto Torell, of Lund, was also elected a foreign correspondent of the society. The following communications were read:—

"On the Geological Position and Geographical Distribution of the Reptilian or Dolomitic Conglomerate of the Bristol Area," by R. Etheridge, Esq., F.G.S., Palæontologist to the Geological Survey of Great Britain.—The author noticed the history of our knowledge of the Dolomitic Conglomerates of the Bristol area from which the remains of Dinosaurian Reptiles have been obtained, and then described their mode of occurrence and distribution over the district near Bristol. He regarded these deposits as due to the action of the sea-waves of the later or middle Triassic periods upon the rocks of older Triassic (Bunter) or Permian age during the gradual elevation of the land, and as the probable representatives in point of time of the Muschelkalk, otherwise deficient in Britain. The author then noticed the influence of the conglomerate upon the production of certain minerals, such as calamine and hæmatitic iron-ores, and discussed at some length the probable course of the phenomena of denudation which furnished the materials for the formation of the conglomerate at different levels, in which he recognized two great periods of oscillation, the first witnessing a downward movement of the Palæozoic lands and lasting throughout the deposition of the New Red Marl and Sands, and the second, during which the accumulations of the former were again, at least partly, denuded. With regard to the time at which the remains of Thecodont reptiles were imbedded in the conglomerate, the author inferred from the evidence that this took place late in the period of the Keuper.

Discussion.—The president inquired on what ground the author considered these reptiles to belong to a late period in the Keuper, and was informed that the author spoke especially with relation to the Keuper of the Bristol area, of which the beds containing them occupied the highest position.

Prof. Ramsay considered these conglomerates not merely as of marine origin, but as breccias which had covered the whole land surface which had been worked up by the water of the New Red Period. He objected to the term sea having been introduced into the paper, as though the tracts may have been islands and promontories; and though the water which surrounded them was salt, there was no open sea, but merely a large inland salt lake, in which the new red marl was formed. The marl was less connected with the new red sandstone than with the lias. The Muschelkalk being absent, it was constantly the case that the marl rested immediately on the palæozoic rocks without the intervention of the bunter sandstone. He thought that there were good grounds for connecting the Rhætic beds with the new red marl below and the lias above. The probability was that the change in character was due to a gradual influx of the sea into the inland lakes. He thought that the Thecodont Saurians might also eventually be found even in beds of Liassic age.

Prof. T. Rupert Jones remarked that Mr. Tawney and Dr. Duncan had already intimated the St. Cassian aspect and character of the Sutton beds. The freshwater character of some of the Keuper beds was, he remarked, indicated by the presence of *Estheriæ*, and he alluded to the fact of the Bristol palæosaurians having been erroneously used as Permian characteristics in Russia and Carolina.

Mr. W. Boyd Dawkins had found at Cheddar that the Dolomitic conglomerate formed two great tongues running up ravines in the older rocks, which had probably been due to subaërial action.

Prof. Morris alluded to some sections which seemed to corroborate the views of Mr. Etheridge, and pointed out the relation of the conglomerate beds to the overlying strata at those points. He also mentioned certain peculiarities in the structure of the conglomerate itself.

Mr. Etheridge stated in reply that the Marls in the Bristol area were the exception, the greater part of the New Red beds being sandstone.

"On the Superficial Deposits of portions of the Avon and Severn Valleys and adjoining Districts," by T. G. B. Lloyd, Esq., C.E., F.G.S.—The author, after describing the general characters of what he termed the Drifts of the Upper and Lower series, and the freshwater gravels of the Lower Avon, comprised within the district of the Avon Valley between Tewkesbury and Rugby, and of the Severn Valley above and below the town of Worcester, endeavoured to show that there was a balance of evidence in favour of the existence of an upper and lower platform of drift in the main valley of the Lower Avon, the upper one being of marine origin, and probably belonging to the same epoch as the stratified beds of gravel in the neighbourhood of Worcester, which contain marine shells and mammalian remains, whilst the lower one, of freshwater origin, had been derived from the former by fluviatile action, as supposed by the late Prof. Strickland. Further, that there was no evidence to warrant the supposition of the existence of high and low level river gravels in those portions of the Severn and Avon Valleys under review, and that the apparent absence of any freshwater shells in the gravels of the Severn Valley between Bridgnorth and Tewkesbury led to the inference that the freshwater gravels of the Avon were not represented in the adjoining portions of the Severn Valley, although remains of some of the same species of Mammalia occurred in both localities. After stating his opinion that the time had not yet arrived for indulging in theoretical speculations concerning the phenomena of the Drifts of the Upper and Lower series exhibited in so small an area as the one under consideration, the author concluded by expressing hopes that the facts which he had brought forward would contribute their share of help to the further elucidation of the question.

"On the Surface Deposits in the Neighbourhood of Rugby," by J. M. Wilson, Esq., F.G.S.—The author commenced by noticing the general configuration of the surface of the district under review, which he stated to consist of an elevated plateau, bounded and rendered irregular in its outlines by valleys. The district consists chiefly of Lower Lias, with a few patches of Middle Lias. The surface-deposits on the plateau and on similar high lands in the neighbourhood consist of—1. Flinty or quartzose drift. 2. Sugary sand, with grains of chalk. 3. Clay, with pebbles, principally of chalk, and distinctly striated. The valleys bounding the plateau were described as belonging to two systems, those of the Avon and Leam. The bottom of each valley is generally a narrow strip of alluvial soil, bordered by sand in some places, and by drift in others. The author has bored down into the surface-deposits in the valley of Low Morton. In one boring, which reached a depth of 53 ft., he stopped in a greyish clay containing chalk-particles; in another, through similar clay to a depth of 57 ft., the rock was reached, and fragments of limestone were brought up.

Discussion.—Mr. Searles V. Wood, jun., had long been aware of the existence of the Middle Glacial Sand near Rugby. He pointed out the difference in the fauna of the sands of the Severn Valley below the glacial clay and those of similar deposits in the east of England, but notwithstanding thought they might be of the same age.

Mr. Gwyn Jeffreys was doubtful as to the authenticity of some of the shells which had been brought to Mr. Maw. The fossil shells from the Severn Valley, Wolverhampton, Manchester, and Moel Tryfaen, were nearly identical, and indicated raised beaches. He thought it possible that a definite line of such beaches might eventually be recognized through that part of England.

Mr. W. Boyd Dawkins did not consider that there was any marked difference in the mammalian fauna of the Avon and Severn Valleys. He had failed to discover any traces of *Elephas antiquus* in either.

Mr. Prestwich thought that the author had probably divided the superficial beds into too many separate deposits, though the facts brought forward were of great value.

Mr. Evans mentioned that he had received information of the discovery many years ago of a flint implement in association with the bones of extinct mammals at Lawford. This implement had been exhibited at the time to the Geological Society, but had disappeared after the meeting.

Mr. Lloyd and Mr. Wilson briefly replied.

The following specimens were exhibited:—Specimens from the Conglomerate Beds of Somersetshire, illustrative of Mr. Etheridge's paper; exhibited by Horace B. Woodward, Esq., F.G.S.

ROYAL GEOGRAPHICAL SOCIETY.

ON Monday evening, January 10th, a meeting of this society, presided over by the president, Sir Roderick Murchison, was held in the British Institution, Albemarle-street. The attendance was unusually large, and among the audience were a number of ladies. After the routine business had been disposed of—

The Chairman said: Gentlemen,—When preparations were being made to inaugurate the opening of the Suez Canal, the enlightened ruler of Egypt, who is one of our honorary members, did me the honour of inviting me through his Minister, Nubar Pasha, to attend that grand and most important international ceremony. Feeling unequal, from the uncertain state of my health, to avail myself of this great privilege, I deemed it to be incumbent on me to have the Royal Geographical Society well represented. For, independently of congratulations on the accomplishment of so vast an undertaking, I felt most anxious to testify to the Khedive the deep sense of my associates and myself of the great services he was about to render to geographical science by the confidence his Highness reposed in our friend, Sir Samuel Baker, and the liberality and generosity with which he had enabled that successful traveller to endeavour to open out and make known to us the true physical geography of large portions of Inner Africa, which, notwithstanding the efforts of Livingstone, Burton, Speke, Grant, Baker, and others, still remained

undefined. I therefore induced my friend, Lord Houghton, who, as one of the trustees, is a permanent member of the council, to undertake this duty and act as the representative of our body, which he did with cordiality; and I doubt not, with his well-known eloquence, his lordship has conveyed to the ruler of Egypt a full recognition of our obligations to his Highness, accompanied with our hearty wish for the success of this great international enterprise. I now call on Lord Houghton to address the meeting.

Lord Houghton, in addressing the meeting, said that when the proposal was made to him, as a trustee, that it would be convenient and appropriate for him to go to the great festivity of the opening of the Suez Canal to represent the Geographical Society, as he was in no wise unwilling, and he was not prevented by any accident, he thought it his duty to do so. He proceeded, like others, under the benevolent arrangements of the Peninsular and Oriental Company. Everything which that company had done, both for the comfort of the passengers and to distinguish themselves in Egypt, was all that could have been desired. If he had returned to this country immediately after the opening of the Canal, he had no doubt that, from all the information he had acquired on the spot, he would have been able to deliver a novel and perhaps an interesting lecture; but after their interest had been satisfied by the ability of the correspondents of newspapers in England and on the Continent, and after their intelligence had been satisfied by the Admiralty report, he was not going to inflict on them a lecture upon the Suez Canal. He would, however, venture to make some desultory remarks on such matters in connection with its opening as he thought had not been prominently brought forward before. To these he would add some details of private experience which it appeared to him might in somewhat interest his hearers. Having read so much about the Canal, stated in moderate language in English newspapers, and in immoderate language by French newspapers, he must express his opinion that the geographical, the commercial, and the political importance of the undertaking had been somewhat overstated. He had seen it compared to and even placed above the discovery of America, because it had been said that to unite two worlds was a finer thing than to invent one world. Now, he thought that the construction of the Suez Canal could not be compared with the discovery of America, or with the circumnavigation of the Cape by the great Portuguese navigator. The Canal was a great work, but it was bad to overstate its importance. Looking at the vast works that had been executed in Egypt ages ago, he could not but think that if the Canal had been regarded as a necessary undertaking in former days it would have been accomplished in those days. He believed that inventions were carried out when they were wanted, and that consequently the Suez Canal was the result of a want of our own time.

When he looked at the works of irrigation that had been constructed in Egypt from the days of the Pharaohs to the days of the Ptolemies, he felt convinced that if the Canal had been wanted it would have been made before the nineteenth century. The truth was no one had wanted it. In former times, the Egyptians would have regarded the intersection of the isthmus by a canal as a contrivance which would lead to the unnecessary intrusion of foreigners and to the destruction of the nationality of Egypt. In the times to which he referred, the Egyptians were anxious for free communication between the Nile and the Red Sea, but not for free communication between the Red Sea and the Mediterranean. The French would tell us that Napoleon I. was the author of the Suez Canal. Well, of course, it was quite right they should say he was the author of everything. No doubt the notion of such a communication passed through the mind of that great man, as did a great many other notions, to some of which he gave effect, while others passed away. But the idea of carrying out the project was due to Père Enfantin, of the St. Simonians, who, in 1833, interested M. Ferdinand Lesseps, the French Vice-Consul, and Mehemet Ali, the Pasha of Egypt, in taking practical measures towards its accomplishment. Surveys were taken, but owing to the breaking out of a plague and to other causes not much more was heard of the scheme till 1845. In 1846, La Société d'Etude du Canal de Suez was formed, and among the names of those who then applied their attention to the subject was to be found that of Robert Stephenson, but he instituted inquiries the result of which was entirely unfavourable to the enterprise. He recommended the construction of a railroad through Egypt, and a line was made between Alexandria and Suez. But, notwithstanding the opinion of Mr. Stephenson, M. Lesseps persevered with wonderful energy, believing, on the report of other engineers, that the scheme could be successfully carried out. M. Lesseps had not invented the Suez Canal. In fact, who did invent anything? An invention was the result of the information and the deductions of thousands of other men. M. Lesseps' undertaking was the complement of what had already been done by other men; but no less honour was due to him because it was so.

The noble lord then proceeded to say that, having arrived at Port Said about two months ago, he found himself one of a very small body of Englishmen. He doubted if there were more than a 100 of them, the invited and the uninvited both included. It was not the same with other nations. France took full advantage of the invitation, and he did not say it was unjust that she should have done so. Nubar Pasha was a generous and intelligent gentleman, for whom every one acquainted with him must feel the greatest esteem, and, therefore, he did not intend any reflection whatever on that high personage, or on the Egyptian Government, when he referred to the inconvenience to which the guests of the Khedive were subjected when at the last moment it was announced that the large and magnificent steamers on board which they had all been placed, were too large to be taken through the Canal. However, he was fortunate enough to get a passage with Mr. Elliot and Mr. Pender on board the *Hawk*, and he had the great advantage of going through the Canal with two great engineers—Mr. Hawkshaw and Mr. Bateman. M. Lesseps recognized him as an individual, and said he was happy to recognise him as one who had been a friend to the Canal when it could boast of but few friends in England. Here he begged to be allowed to say a word in reference to a subject on which there had been a great deal of criticism,—namely, the opposition which Lord Palmerston had offered to the subject. He met M. Lesseps at a time when there was much ill-will against that great man in France because it was thought by the French people that he exercised an almost undue amount of political influence against the construction of the Canal. He owned that on this subject he had differed from Lord Palmerston, because he thought that if the Egyptians and the French made up their minds that the Canal was to be made it would be made, and our opposition would be useless; but he must say that the project which Lord Palmerston opposed was not the one which M. Lesseps had since carried into effect.

If the arrangement originally proposed between M. Lesseps and Said Pasha had been carried out, the effect would have been that a large portion of Egyptian soil—an Egyptian province, in fact—would have been transferred to a French company. Lord Palmerston thought it was not a necessary element in a commercial enterprise that a whole province of Egypt should be handed over to a French company, and he caused that view to be represented so strongly at Constantinople, that a new agreement was come to and compensation was given to the company for the quantity of land which would have been given to them had the original arrangement been carried out. The company which had actually constructed the Canal had no more land than the banks. At the same time he must express his opinion that Lord Palmerston's political opposition to the Suez Canal was hardly in consonance with his usually moderate policy. Such events as the construction of the Canal would come about in the fulness of time under any state of political circumstances whatsoever. When the guests arrived at Ismailia they found every comfort. The soundings made from the *Hawk* never were lower than 18 ft. He ought to observe that when M. Lesseps was presenting Mr. Hawkshaw to several persons of distinction, he said, "This is the gentleman to whom I owe the Canal." That was true. When public opinion had set in very strongly against the scheme, the Khedive consulted Mr. Hawkshaw. He asked him to report confidentially on the project, and in giving him this commission he told him that should the report represent the scheme as impracticable, he would put an end to the work without compromising him, and without injury to any one. Mr. Hawkshaw reported that the Canal could be made, and that it could be maintained at a moderate expense.

On the passage of the *Hawk* those on board did not observe any large amount of sand or anything to materially encumber the Canal. Every one had been told how it was discovered that at one point a rock had cropped up suddenly, but it had been removed without any engineering difficulty, and he believed that no vessel had been scraped by it. There would be no difficulty in deepening and widening the Canal. At certain points it was not now sufficiently wide to permit of two vessels passing each other. Mr. Hawkshaw thought that if it allowed of this, it would be sufficiently wide. At Ismailia he was presented to the Khedive on board his own yacht, and presented to him the congratulations of the Geographical Society, at which his Highness expressed his gratification. The Khedive was at the moment in a state of excitement, and he explained the cause by saying, "Last night I had rather a hard time of it. I was anxious that everything should be prepared for the passage of *L'Aigle*, the yacht of the Empress of the French. A vessel was sent forward to clear the way, but she came to grief by getting against the bank." It appeared that the captain despatched a messenger to Port Said, and had the Khedive called up. His Highness started on board his own yacht with 300 workmen, and went to the scene of the disaster. There, said his Highness, "Je faisais un peu le capitaine moi-même." He added, that if he could not have got the vessel off he would have blown her up.

What would be the effect of the Canal as regarded trade? To the small trade of Italy, Greece, and the Levant it must be very advantageous; but he believed that it would have very little effect in respect of either the commerce of France or that of England. If it should have any considerable effect on the commerce of either country, such a result would not follow for years to come. In conclusion, the noble lord referred to the expedition of Sir Samuel Baker. He saw

him at Cairo at a time when he hoped that he would have been far on his way to that great expedition. No doubt, when Sir Samuel left England he had an extravagant idea of the interest which the Government and the people of Egypt took in the work which he was going out to accomplish; but, as the supply of domestic servants in that country was obtained by means of slavery, the inhabitants generally were not very favourable to the object of Sir Samuel Baker's mission. He was sure, therefore, that the English nation would make allowances for the difficulties which Sir Samuel had to encounter, and would feel satisfied that all which chivalry, intelligence, and determined energy could do would be done to accomplish the great work in which he was engaged. Having thanked the meeting for the attention with which they had listened to him, the noble lord concluded his address amid general cheering.

Sir F. Arrow, as a practical seaman, saw no difficulty in the way of maintaining the Canal in such a manner as that it would be available for large ships. He believed that it would be of great advantage to the commerce of the world, that there was a bright future in store for it, and that though our *entrepôt* trade might be damaged by it we should reap more than a counteracting advantage in an increase of our larger trade.

Sir Bartle Frere had been at one time somewhat sceptical about the Canal; but, after a careful examination of it, he now believed that its commercial advantages would be considerable to this and other countries. It would save the necessity of transhipment, which in brittle articles and in heavy cargo was a very important matter. In reference to the opposition of Lord Palmerston, he believed it was based quite as much on that distinguished man's antipathy to slavery in any form, as it was on the territorial question to which the noble lord (Lord Houghton) had alluded. It had been proposed, as one of the conditions on which the French company was to take the project up, that the work was to be executed by means of "free labour." Under such a system, the poor fellahs would have been obliged to work for a small ration of food. Lord Palmerston bore in mind the loss of health and life occasioned to poor Egyptians who had laboured on similar terms, and he felt that no undertaking should be carried out in that way. Only two years ago, M. Lesseps said to him that he owed the success of his Canal to his not having had labourers of that sort, because he had turned his attention to the mechanical contrivances used for dredging on the Thames and the Clyde, and the result was that the work had been done in half the time and at half the expense that would have been necessary if the dredging had been done by the manual labour of fellahs.

Mr. Fowler said that the dredges used in the construction of the Canal were of a new description. They were wonderful mechanical contrivances, and but for them the Canal would not have been finished now. They were not the contrivance of M. Lesseps, who was not an engineer, but of one of the contractors, a distinguished engineer, who had got his technical education in France, and his practical education in this country. Four principal points of difficulty had been stated by persons who had doubts as to whether the Canal could be maintained in an efficient state. First, the entrance of Port Said; secondly, the supposed falling of the sands into the Canal; thirdly, the washing away of the slopes; and, fourthly, the great evaporation caused by the vast expanse of the Bitter Lakes. He had stated his opinion on some of those points in a letter to the *Times* about a year ago; but, as to the sands, he would observe that along a large portion of the Canal the water of lakes interposed between the Canal and the Desert. Throughout that portion the sands would not operate on the Canal. Indeed, the portion of the latter on which the sands would operate was very short. He therefore regarded the deposit of falling sand as one of the least of the perils to which the Canal would be liable. His conviction was that the Canal would be used largely for the commerce between England and India, and between France and India.

Some other gentlemen having made a few remarks on the subject, thanks were presented to Lord Houghton for his address; and some other business having been transacted, the meeting adjourned.—*Times.*

MANCHESTER MICROSCOPICAL SECTION OF THE LOWER MOSLEY-STREET SCHOOLS NATURAL HISTORY SOCIETY.

A CONVERSAZIONE was held on Monday, January 10, about 120 being present. The members brought their microscopes, and other objects relative to the science of microscopy were exhibited. J. Barrow, Esq., president, in the chair.

The president stated that the object of the meeting was to create a taste for the study of microscopy, to show the work of the members, and to give some idea of the pleasure the microscopist enjoys. He gave a short address on "The Life-History of Ferns," showing the value the microscope had been in defining their organization.

Mr. Aylward exhibited with Reade's prism various Diatoms, two small aquariums containing animalcula, a number of trays of foraminifera, &c.

Mr. Armstrong.—A series of insects mounted whole, a number of slides of various parts of insects, some human anatomical preparations, and a number of micro-photographs.

Mr. Hope.—A number of ferns and miscellaneous slides.

Mr. Chaffers.—Sections of mollusca.

Mr. Hyde.—Vegetable cuticles.

Mr. Jackson.—A series of seeds, and a number of ferns showing fructification.

Mr. H. C. Armstrong.—A number of corallines, scales, foraminifer, &c.

Mr. Armstrong exhibited with the gas microscope a number of slides of Diatoms, insects, parasites, &c.; also by oxy-hydrogen lantern, micro-photographs taken on Dr. Maddox's principle. This was exceedingly successful, and added considerably to the interest of the meeting.

The president then read the list of papers for the present quarter.

LEEDS PHILOSOPHICAL AND LITERARY SOCIETY.

THE second of the course of Christmas afternoon lectures in connection with the above society was given on the 13th inst., by Mr. Henry Denny, A.L.S., the respected curator of the museum. His subject was "The Transformation of Insects," and on this Mr. Denny discoursed for about an hour. There was a fair attendance, including Dr. Heaton, the president of the society.

DUBLIN NATURAL HISTORY SOCIETY.

THE usual meeting of this society was held on January 5th, in the Royal Irish Academy House, Dawson-street, William Andrews, Esq., V.P., in the chair. After the usual business was disposed of, Mr. Andrews read the following paper, "On the Inhabitants of the Rock-pools and Caves of Dingle Bay," during the reading of which the chair was occupied by Rev. Professor Haughton.—When contemplating the host of observations that naturally would present themselves for the paper of this evening, "Notes on the Inhabitants of Rock-pools and Caves of Dingle Bay," the selections would be so varied and extensive that many evenings would be occupied. I therefore will confine myself to a few of the most remarkable of those beautiful tribes of sea anemones or class zoophytes, which careful investigations have noted. From the entrance of Dingle Harbour, both easterly and westerly in the bay, are a series of caves and rocky ledges or islets, exposed at low tides. The caves are more or less deep and tortuous, and their examinations are difficult to attempt from the constant prevalence of westerly winds, which generally send a rolling swell through them. The innumerable and brilliantly-coloured objects of animal life that have existence there cannot easily be seen in their developed beauty but at low tides, and many at only the lowest springs. It was therefore that during those equinoctial low tides, in the month of October, 1868, that I was enabled fully to appreciate the countless forms of interest that everywhere presented. I shall now merely give a few extracts from my notes.

Anthea cereus.—The two varieties occur most abundantly in Dingle Harbour, attached to *Zostera marina* and *Chorda filum.* The deep-nosed Pipe-fish (*Syngnathus typhle*) was noticed to feed on the young state of anthea, and the grey mullet also feeds on the full grown. Anthea is also attached to rocks at the entrance of the caves. *Aiptasia Couchii.*—In a large and beautiful cave westerly of Dingle Harbour, when collecting fine specimens of the sponge Pachymatisma, I was surprised at the singular appearance of this actinia, so nearly allied to Anthea. It was at an extremely low tide, and the Pachymatisma was barely covered by the water, but in most instances Pachymatisma was many feet below the surface—in fact, the sponge in that locality is not attainable but at the lowest tides. Attached to the rocks, near the sponge was the Aiptasia, in a perfect state of expansion. The tentacles as figured in Gosse, are perfect; the colour of the column was more ruddy brown. *Sagartia, sphyrodeta, rosea,* and *venusta* were found in pools, the two latter also seen attached to the face of rocks in caves at low tides. The rocks known as the Banaghrees, and those near Coosavonghala, are rich in marine productions, but they can only be explored by boats in moderate weather. *Sagartia miniata.*—Surface of rocks in little pools. *Sagartia troglodytes.*—East side of Dingle Harbour, rocky pools, imbedded in sand. *Sagartia parasitica.*—At a very low tide in one of the deep caves, brought up by means of a small dredge net from a depth of 4 to 6 ft. It is well described and figured by Gosse. It is a western species, and among the instances of Mediterranean forms that are met with at this part of the coast. *Actinolobia dianthus.*—At low water along its range, attached to the rocks, I saw most abundantly this beautiful Actinia. *Adamsia palliata.*—Taken up in deep water close to the cliffs, where those large rocks are off the cliffs, called the Smoothing Iron. I suspect that Adamsia is to be found on several species of Buccinum. I observed a species on *Purpura lapillus,* and a very pretty form taken up in forty fathoms on *Natica nitida. Actinia mesembryanthemum* occurred in some abundance, particularly the green and varied spotted varieties, mostly attached

to the face of the rocks and at the margins of the caves. Where retractile I could scarcely know the difference between some of the green varieties of *Sagartia chrysosplenium*, both being of nearly the same shade of pale green, and with dotted lines of white. I did not see forms expanded I could identify as *Sagartia chrysosplenium. Tealia crassicornis.*—This beautiful species was not uncommon in the caves, and on rocky reefs outside the caves. Some large and beautiful varieties were noticed near Fort del Ore, Smerwick Harbour. I have a perfect recollection of noticing, and indeed noting, a beautiful species of Cerianthus, similar to Lloydii, in muddy recesses on the west side of Smerwick Harbour. A Stomphia, agreeing with Gosse's figure of *Stomphia Churchiæ*, with exception that the colour of the rim of the disk was a bright purple or carmine lake, was taken up in deep water (40 fathoms), attached to a stone.

I may here introduce that, while noticing some singular species of ova that were numerously congregated and attached by pedicels to the sides of the rocks, and also on detached stones (ova of *Purpura papillus*), my attention was struck with a pretty coral, which, on minutely examining, I supposed to be dead specimens of *Caryophyllia Smithii.* At the very lowest ebb that occurred during the tides of October, 1868, I in vain sought on the faces of the rocks and in the pools for *Caryophyllia Smithii*, but I was rewarded by meeting that very beautiful coral *Balanophyllia regia.* It was in the recesses of a rocky pool barely covered with water; it could not be extricated it was so imbedded. On the following day I again visited the spot, provided with a heavy hammer and chisel, to force off some of the rock. The tide had fallen to its greatest extent the previous day, and the Balanophyllia was not after within reach. On the closest examination I could neither discover *Caryophyllia Smithii* nor the little coral. In the month of August last I dredged *Caryophyllia Smithii* in the living state in 52 fathoms. I am, therefore, fully confirmed in the view that it is a deep-water species. In the *Natural History Review* for April, 1859, Dr. E. Perceval Wright expressed surprise that Thompson should have recorded *Cyathina* (*Caryophyllia*) *Smithii* taken on the Nymph Bank, off Waterford. "This," he says, "I regard as rather a strange locality, never having dredged them in deep water, and my own experience and that of Mr. Gosse would go to prove that it occurs at, or near, low water rocks adhering to the perpendicular sides of rock." At the entrance of Dingle Bay, in upwards of 50 fathoms, this beautiful coral was dredged, and I obtained numerous fragments of the same coral among fine shelly sand in 60 fathoms. I am glad to find its deep-water tendency confirmed by Mr. Jeffreys, for since the paper I gave on the 15th November last, at the Royal Dublin Society, in which I alluded to the deep-water soundings where I had obtained Caryophyllia, Mr. Jeffreys, in his report of the deep-sea dredging expedition in H.M.S. *Porcupine*, given in the journal of science *Nature*, of 2nd December last, states that he has dredged it in 110 fathoms, about 40 miles off Valentia.

Such new facts have been brought to light, and old ideas dispelled, that it is to be hoped that Government may in the course of this year again enable, with improved appliances, the same men of science to prosecute further inquiries, for the result of such expeditions must ever be regarded with intense interest. As I have chiefly alluded to the sea-anemones, I may mention, when speaking of Stomphia as a deep-water species, I met another form in the same soundings—viz., among small stones and where *Nullipora compressa* was abundant, which, when brought up and placed with other animals in a bucket of water, I could not but observe its remarkable features. It was attached to a flat stone, and had the appearance of a column, partially encased in a lobed tube. It did not long remain in that state for examination, and it contracted to a most undefined form in spirits. In seeking references that might lead to some approximating characteristic, I found none so nearly similar as the *Capnea sanguinea*, described by the late Professor Edward Forbes, in the *Annals af Natural History*, vol. vii. page 81, captured in August, 1840—"Habitat, deep water, Irish Sea, occurring among Millepora." Professor Forbes further states that where the Capnea was dredged, the sea-bottom was chiefly Millepora. What is this Millepora of the Irish Sea? It is certainly a deep-water species, a stony coral formed by hydroid animals, and related to the tabulate Madrepores, and is nearly allied to, and, indeed, considered identical with *Millepora alcicornis* of Linnæus. Thus, the animals of this Millepora, which I obtained in the living state, are true hydroids, and similar to those which form the structure of Pocillopora. We are well aware that the growth of those corals which form coral reefs of solid stone is entirely confined to warmer regions, their extensions being almost limited to within a few degrees of the tropics. With regard to the depths at which the animals of corals exist, but few seem to have understood the extreme depths in which those hydroids and polyps are in active life. Sir Charles Lyell mentions the several genera of coral that are littoral and sub-littoral, and that the distribution of particular species in regard to the depths of water in which they grow is remarkably uniform. According to Darwin, reef-building corals rarely live at a depth exceeding 120 ft., although it has been shown that some species of coral have been obtained at depths of 900 ft. In temperate climates it is stated that such species as *Caryophyllia Smithii* are sub-littoral. Dr. A. N. Bell, late Surgeon United States Navy, who has written on Protozoa and on Coral polyps, says that living coral polyps always work upwards towards the light, and that they cannot exist at a greater depth than thirty fathoms. Their peculiar office seems to have been to plant themselves on submarine elevations, and build them up to the surface of the water."

Professor Macalister read a paper "On the Mode of Growth of Univalved Shells," giving it as the result of his observations that univalves grow according to a definite law, and that we could mathematically calculate the relations of the parts of these shells.

The Rev. Dr. Haughton read a paper "On the Geometrical Classification of Muscles."—Referring to Borelli's old classification, he made several alterations in it, adding to it, among others, the class of muscles whose fibres, though straight lines, yet conjointly make skew surfaces.

GLASGOW PHILOSOPHICAL SOCIETY.

CHEMICAL SECTION.

THE ordinary meeting of this section was held on the evening of Tuesday, Dec. 21st, 1869, Dr. Wallace, F.R.S.E., one of the vice-presidents, in the chair. Several new associates were balloted for and admitted.

Mr. W. R. Hutton, manufacturing chemist, read a paper "On the Chemistry of Coal-Smoke."—The author glanced at the subject both in its sanitary and its economical aspects; and then, in order that the scientific principles involved in the prevention of smoke, and in the complete utilization of the heating power of raw coal, might be properly understood, he gave an analysis of best Wishan coal, one of the finest kinds of fuel in Scotland. It was as follows:—

Water	2·8
Sulphur	0·4
Volatile matter	36·9
Fixed carbon	56·3
Ash	3·6
	100·0

VOLATILE MATTER.

Carbon	14·0
Hydrogen	6·0
Oxygen	15·9
Nitrogen	1·0
	36·9

In the ordinary combustion of coal, black smoke, and therefore soot, is only producible from the volatile matter of the coal, the fixed carbon, ash, &c., being incapable of generating smoke. The value of a fuel as a generator of heat is estimated according to the amount of carbon and hydrogen present in it. As ordinarily used, coal, during its combustion, gives rise to many curious compounds, including carbonic oxide, carbonic acid, watery vapour, ammonia, sulphurous and sulphuric acids, and various hydrocarbons, some of the paraffin series, and others of the naphthalin series; and, as they are volatile when liberated, they rise into the atmosphere and form the mixture known as coal-smoke. This material differs in its properties and composition, according to the composition and mode of burning the coal; but, in all cases, sooty carbon and moisture are abundant, the former especially so in black smoke. But black smoke is soot, and is the result of the imperfect combustion of the coal, and even of its wasteful use. Mr. Hutton then went on to examine soot in its chemical aspects, and explained, in detail, how the difference of temperature in a furnace or domestic fire regulates the composition of the volatile matters of soot. The composition of London and Glasgow soot was shown in a table, of which the following is a copy.

ANALYSIS OF SOOT.

	London.	Glasgow.
Carbon	53·18	35·7
Tar and oil	18·00	15·0
Ammonia	1·75	2·8
Potash	0·20	0·3
Soda	0·34	0·3
Lime	1·00	0·8
Magnesia	0·30	trace
Phosphate of lime and alumina	2·08	3·2
Iron	0·40	0·7
Sulphuric acid	4·60	7·9
Chlorine	trace	0·4
Sulphocyanogen	0·25	none
Carbonic acid	0·70	trace
Sand	14·40	25·7
Water	2·80	7·2
	100·00	100·0

The author said he could guarantee the genuineness of the sample of London soot; but he was afraid that the Glasgow soot which he had examined was adulterated, judging by the large percentage of sand and water contained in it. The large proportion of sulphuric acid might be accounted for by the sulphurous quality of the Scotch coal, and by the great number of chemical works in Glasgow. Genuine Glasgow soot ought to contain a larger amount of ammonia. Both samples were distinctly acid. While referring to the various uses of soot, Mr. Hutton mentioned that a considerable quantity was recently shipped to the West Indies, to be used there for the growth of sugar-cane. The price is from 30s. to 40s. per ton. Considering that soot rarely contains less than about ¼ of its weight of hydrocarbon compounds, the author of the paper proceeded to look at the production of soot from a commercial point of view, and asked if the value of soot is proportionate to the evils resulting from the production of the material. Not more than 500 tons are gathered in Glasgow per annum, and the value never exceeds £1,000. Taking the waste of fuel, the loss of the nitrogen of the coal, the destruction of property, and the personal discomfort resulting from smoke and soot, he found that there was no profit, but rather a great loss instead. As a practical solution of the "smoke nuisance," Mr. Hutton briefly sketched a plan by which practically smokeless fires might be obtained, while all the volatile compounds could be separately collected, and be got in a form fit for utilization. He would distil the coal before burning, stopping short the process of distillation at such a stage as would permit *soft coke* to be formed—that is, fixed carbon with a sufficient amount of volatile matter in it to render it slightly inflammable. The other useful products would be chiefly crude oil, coal-gas, and ammonia. Assuming, as a basis of calculation, 2,000 tons of coal to be used daily, that amount would yield, in round numbers—

Soft coke	1,400	tons.
Crude oil	40,000	gallons.
Ammoniacal water	30,000	,,
Coal gas.....	6,000,000	cubic feet.

Deducting the ash, the fixed carbon would be reduced to 1,329 tons. Mr. Hutton calculated that the coke and the other products would realize £742, while the coal (at 5s. per ton) and the labour, &c., would cost £600, leaving an apparent balance of £142, in addition to all the other advantages which would result from the complete combustion of the fuel. The coke would be such a material as would be available alike for domestic fire-places and the furnaces of steam-boilers, &c.

At the conclusion of the parer, various members spoke in commendation of Mr. Hutton's views. In reply to Mr. Stanford,

Mr. Hutton stated that such coke as he had suggested in his paper could be burned in the ordinary grate, without the expense or any other of the inconveniences attending the use of the grate which was devised some years ago by the late Dr. Neil Arnott.

On the motion of the chairman, a cordial vote of thanks was awarded to Mr. Hutton; and the meetings of the section were adjourned for a month.[1]

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, JANUARY 10TH, M. Liouville presiding.—The correspondence included the following communications: A letter of thanks from M. Cornalia, on his election as correspondent. A note from M. Chavrard on the construction of aërostats. The Report of the Inspector of the Seine. Observations on the Postulates of Euclid. A Reply from M. Feil to the "Reclamation" of M. Gaudin; and, lastly, an elementary exposition of the atomic theory, by Professor Williamson.

M. Schloesing, director of the École d'Application des Manufactures, sent in a note on the analysis of the soluble matters found in arable soils, but M. Dumas did not give a *résumé* of it.

MM. Odet and Vignon gave an account of the theory explaining the reaction which takes place in the production of nitric anhydride.

M. Mecker sent in a paper relative to the disease of the vines at the Cape of Good Hope. The vines have been attacked by an acaride, which eats the rootlets and threatens to become desperately destructive.

M. Collin, of Alfort, sent in a memoir on a subject which, however, has been often worked out before, viz., the ratio between the weight of the brain and the weight of the body. He has found that even in the same species this ratio varies within the widest limits. The cephalic mass is proportionally larger in small animals than in large ones. In the same species the ratio varies inversely as the age of the individual. The ratio in question is far from expressing the degree of intelligence of the various animals, and hence the author concludes that there is no relation between the development of the brain and the development of its faculties.

M. Bergeon, in a paper on the lachrymal gland, announces quite a new function for this organ. He thinks the purpose of this gland is the lubrication of the upper parts of the respiratory passages.

Two tom-toms were exhibited on the table, and their tone was identical with that of those made in China. They were manufactured by MM. Riche & Champion, under direction of Chinese artificers. They were presented by M. Stanislas Jullien.

M. le Docteur Bonnafont gave an account of his observations on acute inflammation of the *membrana tympani*, accompanied by nervous symptoms.

M. Lacaze-Duthiers continues his researches on the morphology of acephalous and lamellibranch mollusks. In this last communication he shows of what value the anatomy of the digestive system is in establishing a philosophic morphology.

M. Frémy stated some novel facts in connection with his experiments on nitrous acid. Contrary to the usually accepted view, he says that it may be dissolved in water without decomposition, provided it be there in excess. Boiling decomposes the liquid, and nitric oxide is evolved. In treating nitrite of soda with sodium amalgam, M. Fromy obtained a new substance, which appears to be a new oxide of nitrogen with very peculiar properties.

The place of correspondent in the section of Physics, vacant by the death of Signor Matteucci, has been given to Herr Dr. Mayer by 40 votes, against 5 for Kirchhoff, 1 for Angström, and 1 for Johnson.

M. Becquerel continues his interesting researches in electro-capillarity, and on the relation of these phenomena to vital processes.

M. Ed. Becquerel described a new battery of feeble power and great constancy; it consists of plates of zinc and amalgamed zinc in a solution of neutral sulphate of zinc.

M. Delaunay presented a memoir by M. Simon Newcomb, in which the author endeavours to prove that Hansen's notion that the centre of gravity of the moon being different from its geometrical centre, and that the face turned from us is therefore placed under quite different conditions from the visible one, is based on unsound data.

NOTES AND MEMORANDA.

Method for Drying Vegetable and Animal Substances.—A method recently adopted for drying vegetable and animal substances, consists in filling a vessel half full with fused chloride of calcium, pouring ether upon it, and then placing above it a vessel containing the material to be dried. The vessel is placed upon a glass plate, and over this a bell-glass, fitting completely to its surface. The chloride of calcium abstracts the moisture from the ether, which then constantly takes away a new quantity from the substance in the vessel above, until it is quite dry. Articles dried in this manner have quite a different appearance from those from which the moisture is removed by the ordinary process: vegetables retaining their natural colour, and animal substances their elasticity and flexibility.

New Work on the History of Chemistry.—Under the title, *Vorträge über die Entwickelungsgeschichte der Chemie in den letzten Hundert Jahren* (Lectures on the History of the Development of Chemistry during the last Hundred Years), Dr. A. Ladenburg has, according to the editor of the *Zeitschrift für Chemie*, edited a most excellent complimentary volume to Kopp's well-known *Geschichte der Chemie*. The work alluded to, says the *Chemical News*, is in the shape of fourteen lectures on the subject; the arrangement is strictly chronological, and, beginning from Lavoisier, contains a complete, yet concise, record of the history of theoretical chemistry up to the present day. This work is highly eulogized by Dr. Fittig, who wrote a review of it for the above-named periodical.

The Cylindrellidæ.—In the current number of the *Journal de Conchyliologie* there is an important paper on this family of mollusks by Messrs. H. Crosse and P. Fischer, in which they argue, upon odontological grounds, that the present position of the family—viz., with the Agnathous group of Geophilous mollusks—cannot be maintained. They propose to place the family among the Gnathous Geophilæ, next the Helicidæ; with the exception of the genera *Encalodium*, *Berendtia*, and part of the genus *Holospira*, which they place with Helicidæ proper. The paper is an interesting one; but is too long and too purely technical to be abstracted in these columns.

SCIENTIFIC DIARY.

WEDNESDAY, January 19th.

Hunterian Society, 7.30 p.m. Council Meeting. "Cases of Injury to Skull and Brain," by Mr. Corner. "On a Case of Popliteal Aneurism," by Mr. Brownfield.

[1] From the *Chemical News*.

Epidemiological Society, 4 p.m. Council Meeting. "On Cholera in Senegambia," by Staff-Surgeon Gunn, communicated by the Director-General, A.M.D.
Royal Society of Literature, 4.30 p.m.
Meteorological Society, 6 p.m. Council Meeting. 7 p.m., Ordinary Meeting.
Society of Arts, 8 p.m. "On the Coral and Pearl Fisheries," by P. L. Simmonds, Esq., F.S.S.
Leeds Philosophical Society, 7.30 p.m. "On the Physiology of Digestion: the Food we Eat, and the Use we Make of It," by Mr. T. R. Jessop, F.R.C.S.
Social Science Association, 4 p.m. Standing Committee of the Repression of Crime Section on the Habitual Criminals Act.

THURSDAY, 20th.

Royal Society, 8.30 p.m. "On the Mechanical Performance of Logical Inference," by W. Stanley Jevons. "Preliminary Paper on Certain Drifting Motions of the Stars," by R. A. Proctor. "On Jacobi's Theorem respecting the Relative Equilibrium of a Revolving Ellipsoid of Fluid, and on Ivory's Discussion of the Theorem," by I. Todhunter, F.R.S.
Society of Antiquaries, 8.30 p.m.
Linnean Society, 8 p.m. "Flora of Iceland," by Prof. Babington. "New British Spiders," by Rev. O. P. Cambridge.
Royal Society Club, 6 p.m.
Chemical Society, 8 p.m.
Social Science Association, 8 p.m. Tenth Meeting of the Session, at the House of the Society of Arts, John Street, Adelphi. Paper by Mr. J. Jones, "On the best means of attaining Concerted Action between the Representatives of the Poor Law and of Private Charity respectively, with special reference to the Poor Law Minute of November 20, 1869."
Numismatic Society, 8 p.m.
Zoological Society, 8.30 p.m.
Royal Institution, 3 p.m. "On the Chemistry of Vegetable Products," by Prof. Odling.
Harveian Society. "On Puerperal Fever," by Dr. Wynn Williams.

FRIDAY, 21st.

Medical Teachers' Association, 8 p.m. Address of the President, Dr. William Allen Miller, F.R.S. Report of the Committee appointed by the Association to consider the possibility of obtaining an increased supply of Subjects for Anatomical Examination. Memorial to the Home Secretary, suggesting an alteration in the Anatomy Act, to be submitted to the Association. Mr. Holmes will move—"That in the opinion of this Association, it is expedient that a portion of the time now given to Lectures should be given to Class Examinations." Dr. Sibson will move—"That the present proposal for the formation of a combined Examining Board is well worthy of the best consideration of the Medical Teachers' Association; and, with a view to this question being fully considered at the next General Meeting, that it be referred to the Council, for their consideration and report."
Philological Society, 8.15 p.m.
Royal Institution, 9 p.m. Lecture "On Haze and Dust," by Dr. Tyndall.
United Service Institution, 3 p.m. "On Working Heavy Guns and Projectiles," by Capt. H. D. Cunningham.
Old Change Microscopical Society, 5.30 p.m. "On Spontaneous Generation," by Mr. H. Pollock.
Social Science Association, 4 p.m. Standing Committee on India and the Colonies.
Society of Arts, 8 p.m. The discussion on Mr. Andrew Cassel's paper, "On a Gold Currency for India," will be resumed by Dr. Boycott, late of the Calcutta Mint.

SATURDAY, 22nd.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. "On Meteorology," by Mr. R. Scott.

MONDAY, 24th.

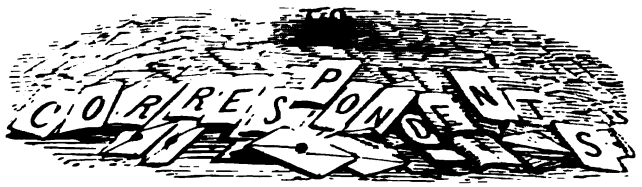
Royal Geographical Society, 8.30 p.m.
Entomological Society, 7 p.m. Anniversary Meeting.
Medical Society of London, 8 p.m.
London Institution, 4 p.m.
Torquay Natural History Society, noon. "On Philosophy *versus* Science in History," by Rev. W. Dawson, M.A.

TUESDAY, 25th.

Manchester Literary and Philosophical Society, 7 p.m.
Institution of Civil Engineers, 8 p.m.
Ethnological Society, 8 p.m. "On the Origin of the Tasmanians Geologically considered," by J. Bonwick, Esq. "On a Frontier-line of Ethnology and Geology," by H. H. Howorth, Esq. "On the Nicobar Islanders," by G. M. Atkinson, Esq.
Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.

WEDNESDAY, 26th.

Society of Arts, 8 p.m. "On the Modes of Reading in Use by the Blind, and the Means for Arriving at Uniformity," by Thomas Armitage, Esq., M.D.
Archæological Association, 8 p.m.
Geological Society, 8 p.m. "On the Crag of Norfolk and associated Beds," by Joseph Prestwich, Esq., F.R.S., F.G.S. "On the Fossil Corals of the South Australian Tertiary Deposits," by Dr. P. Martin Duncan, F.R.S., Sec.G.S. "Note on a very large undescribed Wealden Vertebra," by J. W. Hulke, Esq., F.R.S., F.G.S.



RAIN CRYSTALS.—"A. F. W." is thanked for returning the blocks. Why does he not send us a note now and then on the subject of local meteorology?

STAMPED NUMBERS.—"R.'s" idea is a good one. There are difficulties in the way, however. We will see about it, and, if possible, comply with "R.'s" request.

L'HOMME PRIMITIF.—"H." shall be communicated with at once. We believe the letter was sent by the London house, not by the Paris one.

GALVANIC BATTERIES.—We are sorry we cannot refer "L. T." to any better work. The newest battery is one of zinc, and amalgamated zinc with a neutral sulphate of zinc solution. The Leclanché we have not yet seen, but hope to report on next week or the week after.

SHIP'S LOGS.—"G. R."—Thanks. We fear you have forgotten the promise kindly made in a recent letter to do us justice.

MECHANISM OF WAVES.—"A. G. V. G."—Purchase the volume of Report of the British Association for 1869. You will find the matter there. Our reason for asking our astronomer to define level, was that that would simply have ended his case. He wrote dreadful rubbish. It is idle to reason with men of his stamp.

MANCHESTER MICROSCOPICAL SOCIETY.—"W. J."—The report is to hand. Send it regularly and also any notes or jottings relative to local scientific matter.

GERMAN AND FRENCH BOOKS.—"R. S."—The inconvenience of complying with your wishes would be too great. The same proposal has been made before, but we could not carry it out.

DUBLIN NATURAL HISTORY SOCIETY.—"W. A." is thanked for promptly returning the report. We should feel obliged if he would send it regularly in future. We are old members of the society and wish it well.

BRIGHTON NATURAL HISTORY SOCIETY.—"T. W. W."—Thanks. Send us a note occasionally.

THE BERMUDA DOCK.—"J. H. D."—Thanks for your letter. It would be most useful to the work, in connection with the notice thereof.

ASTRONOMY AS LEARNT FROM THE BIBLE.—We trust "J. H." will not send us any further nonsensical effusions.

SIR W. THOMSON *v.* GEOLOGY.—"P. W. S. M."—The private note has been received. We regret that circumstances prevent your continuing the correspondence just now. We have doubts of the success of such a project as that you mention, but we wish it every success, and congratulate the proprietors on their selection. The letter in this week's number from an "Old Stager" is by one of the best-known geologists in England.

PROFESSOR HUXLEY AND THE LEGISLATURE.—"H. H. S." is quite correct in his first statement. It was through a mere slip of the pen that the error occurred. We do not see the force of Professor Huxley's observations if they were not directed to the legislators, though addressed to working men. In regard to the ethnological point, we reassert our position. "H. H. S." says Professor Huxley gave the facts. If so, and "H. H. S." will favour us with them, we will be most happy to publish them. The subject is one to which we have given some attention, but we shall be glad to receive further light.

"THE UNIVERSE."—Messrs. Blackie are thanked. We hope we shall be able to favour them at the time mentioned.

ZOOLOGICAL SOCIETY.—Our correspondent's letter has been received. The address shall be changed. Yes. We shall be glad of an occasional note.

GALVANOMETER AS A TEST OF INTENSITY.—"Copper-wire."—Yes, within certain limits. Not of much practical value, however. One cell will produce as much deflection as 100. If using a single cell like the bichromate, you first submerge the zinc slightly, the degree of the deflection will be slight. If now you submerge thoroughly, the deflection will be quick and extended.

"JOURNAL DE CONCHYLIOLOGIE."—"T. G. P."—Just to hand as we go to press. Much obliged to you.

E. G. SMEDLEY.—Your remittance of five shillings in stamps is to hand. This prepays to No. 73.

OUR NEW VOLUME.

With a view to meet the extending requirements of this Journal, we have permanently enlarged SCIENTIFIC OPINION, *and have introduced various improvements suggested by the experience gained during the production of the first two Volumes. May we ask Subscribers to remind those of their Scientific friends who are not already in the habit of regularly purchasing* SCIENTIFIC OPINION, *that the commencement of the present Volume presents a very favourable opportunity to intending Subscribers.*

WEDNESDAY, JANUARY 26, 1870.

PROFESSOR TYNDALL ON HAZE AND DUST.

THE eloquent lecture, which Dr. Tyndall delivered before the Royal Institution on Friday night last, and which was listened to throughout by a brilliant and attentive auditory, will be found very fully reported in our pages. But admirable as was the delivery, and ingenious and successful as were the experiments which accompanied that lecture, we think that it did not carry conviction home to the minds of all those who listened to it. Dr. Tyndall's arguments are usually so cogent, and his demonstrations are so convincing, that we seldom find reason to hesitate in accepting the generalizations he lays down; but on the occasion in question he formulated such grave propositions, and to our minds supported them so imperfectly, that we must own to leaving the lecture theatre in a very sceptical frame of mind, and with the impression either that the lecturer had not fully thought out the serious problems which he set himself to solve, or that the narrow limits of the time placed at his disposal did not suffice to enable him to advance all the arguments which he would have otherwise adduced. In the hope, then, that the second alternative supposition may prove to be the correct one, and that Dr. Tyndall will himself help to lighten our darkness, we venture to express a few of the reasons which occur to us as justifying our dissent from the conclusions stated on Friday night last.

By means of the electric light, Dr. Tyndall showed, what of course every one who has watched a sunbeam passing through a slit in a shutter, and dancing its thousand motes in the light, must have known already,—viz., that the air we breathe, and which seems so clear and so empty, is really heavily laden—almost packed—with minute particles. But he went further than this. He asserted (1) that these particles are organic; (2) that they are the germs of plants like the yeast and such-like fungi; and (3) that they are the means by which epidemic diseases are propagated. Each and all of these propositions appear to us incapable of being proved; and we hope that Dr. Tyndall, with that love of fair reasoning which characterizes him, will pardon our attempt to show how the arguments brought forward in their support are open to fallacy.

One of the most beautiful experiments that we have ever witnessed was that in which Dr. Tyndall, placing a smokeless flame underneath the beam of the electric lamp, caused an appearance like that produced by huge volumes of black smoke passing in wreaths through the beam. It is to the mode of explaining the phenomenon that we object. Dr. Tyndall said the heat of the flame destroys the particles; there is thus left in this particular part of the beam no particles to reflect the light to our eyes—hence, black spaces, patches of nothingness, like the darkness of stellar space, are produced; and this is what looks, by comparison, like smoke. Further, said he, the particles having been destroyed by the heat must be organic. Now, we do not go into the question, which after all may yet be raised, as to whether it may not be possible to affect the light falling on the molecules in such a manner as to prevent the particles becoming luminous. Conceivable conditions of polarization suggest themselves. But this by the way. We would, however, ask Professor Tyndall how he can imagine that the heat produced from a flask of boiling water, which he alleges equally produces these black volumes, could possibly destroy, in a moment of time, all the particles, even assuming them to be organic, which lie above it in the beam. Is such a thing conceivable? Is it not the case that a great bulk of recognized organic germs, not only are not destroyed by water at 212°, but are not even devitalized by a much higher temperature? We apprehend that this is so, and that it materially weakens Dr. Tyndall's view. But there is a further point of inquiry. Multitudes of experiments have been made by drawing air through cotton wool and other materials, and examining, both optically and chemically, the *débris* thus collected, and the result of such observations is this, that a great proportion of these particles are inorganic. If this be so, and that these cannot be destroyed by the heat applied in Dr. Tyndall's experiments, how comes it that *they* do not reflect light, and so prevent the smoke-like blackness? All these things appear to us to militate seriously against Dr. Tyndall's opinions.

As to Dr. Tyndall's second proposition—viz., that these organic particles are the germs of fungi, the statement is, we fear, altogether devoid of proof. Indeed, observations such as those of Pouchet, Joly, Musset, Mantegazza, and others, all go to show that the germs of many of the lower vegetable organisms which are familiar to botanists, are not present in the air generally. Nothing short of very exact microscopic observation could prove this point absolutely, and we have heard of no such testimony from Dr. Tyndall.

Finally, as to the third conclusion, which Professor Tyndall laid down with more than usual emphasis. The proposition that these germs are the media by which epidemic diseases are propagated, we must say that—contrary to his assertion—the modern school of physic is opposed to this idea. That certain maladies, as small-pox, scarlet fever, cholera, and such-like, are inoculable, after different fashions, no sane person could venture to deny. But the hypothesis which says that the contagious substance is a vegetable organism, rather than a minute particle of disorganized organic matter, is but an hypothesis, and nothing more. So far as it has been attempted to be demonstrated by the experiments of Hallier and others, it has utterly broken down; and the ablest fungologists in the kingdom—Berkeley and others—are distinctly opposed to it, as are, we believe, the more scientific of our modern physicians. Dr. Tyndall urged really nothing in its support beyond his own declared belief in its truthfulness.

From what we have said, it will be seen why we cannot accept the three categorical statements made by Dr. Tyndall. Our dissent is offered in no cavilling or captious spirit, but in an honest desire for that method of careful generalization which Dr. Tyndall himself so ably advocates and so honourably represents in this country. We have endeavoured to state the facts clearly, to show that they do not bear out the views offered in explanation of them; and if we have misinterpreted them, or in any way fallen into error in our observations, we shall be the first to publish our own correction of them, should Dr. Tyndall deem these criticisms worthy of a reply.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

MR. W. T. DYER, Professor of Botany in the Royal Agricultural College of Cirencester, has been elected to the Professorship of Botany in the College of Science of Dublin, and there is a very strong feeling among Dublin scientific men that South Kensington, in whose hands the appointment rests, has perpetrated a job. The leading Irish journal is immensely indignant, and, so far as we can gather its reasons—for the copy reaches us as we are going to press—not without much

justice. We shall deal with the question more at length in our next; meantime we may state that the Irish journalist asks whether the text is to be applied to Ireland—"Moab is my wash-pot; over Edom will I cast out my shoe."

THE vacant Professorship of Geology in King's College, which we recently referred to, has been filled up by the election of Dr. P. Martin Duncan, F.R.S., to the chair. We congratulate the authorities on the selection of Dr. Duncan for the post they have given him; no more fitting candidate could have been found, and very few, indeed, who, by their ability, industry, tutorial power, or long-tried services in the field of geology are so well qualified for the office. Dr. Duncan has for some time been one of the secretaries of the Geological Society, to whose *Transactions* for years past he has communicated numerous original memoirs. It is as a palæontologist that he is especially eminent, and perhaps on the subject of fossil corals he is the highest European authority. For all these reasons, then, we congratulate the Council of the College on its choice, and we congratulate the new Professor on his election to the professorial chair.

THE Mathematical Mastership in King's College, London, vacant by the resignation of Mr. James Haddon, M.A., has been conferred upon Mr. W. Angel Thomas, who was for four years tutor at the South Wales Training College, and lately nominated to an assistant examinership in the Science Department.

PROFESSOR KÖLLIKER, who is still pursuing his researches on the histology of the Cœlenterata, has just issued a new part of his work on the subject. This is devoted especially to the *Pennatulidæ*.

THE estimation of the position of the absorption bands in the spectrum being a matter of some difficulty to the observer, those interested in such inquiries will be glad to learn that Mr. John Browning, of the Minories, has devised an admirable and very simple contrivance for the purpose, which quite supersedes the Sorby interference scale, the micrometer of Kirchhoff, and the more recent nitric oxide scale. This, which was noticed at the last meeting of the Royal Microscopical Society, will be described at length and figured in the forthcoming number of the *Monthly Microscopical Journal*. In the mean time, however, we may mention that the plan consists in throwing, by lateral illumination, a bright line (a beam from a lamp, sent through a line photographed on a glass plate, the rays being rendered parallel by a lens) upon the spectrum. By means of a micrometer screw the line may be made to travel over the whole of the spectrum, and thus the exact position may be read off in numbers of the screw.

THERE is still an opportunity for the projectors of the Scientific Club. The "Allied Universities Club," to which we lately called attention as being likely to meet the wants of those who proposed a Scientific Club, is not, so far as we can see, suited to scientific men generally. Its prospectus is vaguely drawn up and apparently not under the direction of any experienced member of the scientific world. It proposes to admit members of the recognized Scientific Societies; but the Secretaries do not appear to have framed any definition of the expression "recognized Scientific Society." Who are the recognizers, and what is the basis of their recognition? This Club is still in embryo, and unless its elements become a little less heterogeneous we shall have great fears of its proving ultimately an abortive scheme.

THE Society of Arts is bestirring itself. This year it is more than usually active. In regard to the Art workmanship competition, of which we have heard lately, its efforts have not been unattended with success. In response to the offer of prizes issued by the Council in 1869, one hundred and forty-three specimens have been received for competition in the various subjects for which the prizes have been offered. These articles will shortly be arranged for exhibition in the Society's Great Room. The Council proposes also to held an Educational Conference in the early part of February. The particulars will appear in a subsequent number of the Society's *Journal*.

IN the Faculty of Medicine of Paris M. Ball, *agrégé*, has been directed to give the course of lectures in pathology and general therapeutics in the place of M. Laségue, who is called away by other duties.

KEEPERS of orchid collections, and they are not few in this country, will be pleased to hear of the re-discovery of the glorious *Odontoglossum Warscewiczii*, hitherto, according to the *Gardeners' Chronicle*, known to us only by the plate in Reichenbach's *Xenia*, for which a drawing of the ill-requited traveller whose name it bears supplied the materials. Since the appearance of the figure, every botanical collector visiting the isthmus of Central America has searched—and until now searched in vain—for this plant, which is probably the most beautiful species of the genus to which it belongs. As the fortunate finder wishes the habitat to be kept, for the present, a pro found secret, there is nothing further to communicate beyond the intimation that living plants may be expected in the course of the ensuing season.

BUILDERS in search of a new stone for architectural purposes should know that there is some probability of an importation of stone from the Jura. The *Builder* of Saturday says that its attention has been directed to some specimens of magnesian limestone, exhibited at the Institute of Architects, by M. Paul de Tinseau, proprietor of the quarries at St. Ylie, Jura, France. The stone is described as very hard, and capable of receiving a fine polish, which renders it suitable for the shafts of columns, staircase balusters, mantelpieces, and other decorative details, as well as for ordinary construction of a superior character. The cost of stone delivered in London would be about 3s. per cubic foot.

AT the meeting of the Royal Horticultural Society yesterday week, Mr. Bateman announced that he would give a prize of £5 for the best collection of cut flowers of varieties of Cattleyas, indigenous in cool countries, with the stipulation that the flowers were to become the property of the Society, for distribution amongst the ladies present on the day of competition, and which was fixed for the first meeting of the Society in 1871.

OWING to the death of Dr. Pfeuffer, the well-known *Zeitschrift für rationelle Medicin* of Henle and Pfeuffer ceases to exist. It lived for a quarter of a century.

SHOCKS of earthquake have recently been recorded from various parts of Europe, and especially from France. It seems that on the night of the 14th-15th inst. shocks were felt in various parts of Gers, the Ariége, the Haute-Garonne, and the Haute-Pyrénées. A correspondent writing from Oust (Ariége) says:—"An earthquake lasting quite twenty seconds was felt here at two o'clock. It seemed to travel from east to west. It sounded like a steam-engine with twenty waggons. Fortunately no injury was done.

ELECTRICIANS, whether telegraphic or medical, are likely to find a newly-devised form of battery, known as the *Leclanché* (after its inventor), a very simple, constant, and cheap contrivance. It consists of a porous cell filled with peroxide of manganese, and plunged in a solution of muriate of ammonia contained in an outer cell, in which a bar of zinc is placed as the second element. It is said to be somewhat stronger than Daniell's cell. We have it under examination, and hope to furnish an early report upon it.

THE plans of the new American flying ship, *Aviator*, have been submitted to a thoroughly competent engineer, who, it is said, has pronounced favourably upon them.

Signor Carlo D'Itino has obtained the chair of clinical medicine in the University of Florence.

We welcome two new journals—one, the *Food Journal*, will be edited by Mr. P. Beavan, and will be published by Messrs. Johnson & Sons, of Holborn; the other is called the *Journal of Applied Science*, and has just made its appearance. This is edited by Mr. P. L. Simmonds, and proposes to range over the whole ground of science applied to arts and manufactures. No better editor than Mr. Simmonds could be found for such a journal, as readers of his *Waste Products* must know. But is there really a commercial field for these periodicals? When we hear of the issue of new journals of this class we feel disposed to say, as Abernethy did when he came into a lecture theatre to deliver an opening address to a large class of new students, "God help you all! I wonder what is to become of you."

We stated last week that a question had been raised as to the translation of the last volume of Gmelin's *Chemistry*, and we are happy to find a very satisfactory answer by Mr. Henry Watts in the *Chemical News* of Friday. Mr. Watts states that about 200 pages of the concluding volume are already translated; but for the remainder we have to wait the pleasure of the German editor and publishers, whose movements are not very expeditious. The conclusion was promised last year, but has not yet appeared; when it comes to hand, the translation will be completed with all possible despatch. The much desired index is in progress, and a considerable portion is already compiled; but its completion must, of course, depend on that of the work itself.

If we are to believe the *Medical Press* (of Wednesday last), Dr. Barker, of Dublin, has discovered a method of microscopical illumination which surpasses everything hitherto attempted. We may observe that our contemporary's description of the method is as extraordinary as the method itself, and is really so startling as to be quite unintelligible to us. We await further information.

The *Lancet* says that the University of France has conferred several marks of distinction on various professors of medicine, on account of the services which they have rendered by their teaching. Professors Charles Robin, of the Paris Faculty; Brongniart, of the Institute; Huguier, Professor of Anatomy at the School of Fine Arts; Combal, of the Montpellier Faculty; Goze of Strasburg; Mabit of Bordeaux, &c., have been appointed officers of public instruction, with corresponding privileges.

To use a mild expression, a Yankee paper is generally regarded as something embodying the antithesis of veracity. The following description, however, of the great Sunken Lake, although from a Transatlantic source, is not without interest:—"The great natural curiosity known as Sunken Lake is situated in the Cascade Mountains, about 75 miles north-east of Jacksonville, Oregon. The walls are 2,000 ft. high, and almost perpendicular, running down into the water, and leaving no beach. The depth is unknown, the surface is smooth and unruffled, and it lies so far below the surface of the mountain that the air currents do not affect it. Its length is estimated at twelve miles and its breadth at ten. No living man has, it is said, ever reached the water's edge. The lake lies silent, still, and mysterious in the bosom of the everlasting hills, like a huge well scooped out by the hands of genii."

Professor Moleschott will deliver the opening address at the Turin University.

It is likely that M. Coquand will soon publish another memoir on Spanish Geology. He is now engaged in investigating the geology of Aragon.

The programme of the Social Science Association includes, we believe, everything in the shape of human institutions, from patent laws to prostitution; but it has never produced a more scientific, and withal practical, paper than that published in its last report (January 20th), by Dr. Stallard, "On the Construction of Barracks in reference to the Physical and Moral Improvement of the Soldier." This is a paper which all students of Hygiene should read with care. It is an admirable account of existing abuses, and of their scientific remedies.

Professor Lyon Playfair, M.P., has accepted the office of President of the Birmingham and Midland Institute for the current year. In the course of his letter to Mr. Gansby, the senior Vice-President, he says:—"I accept the office with pride and satisfaction. The Midland Institute was one of the earliest institutions in the country to recognize the importance which science and art are assuming in their relations to industry. I had the satisfaction of joining with others in giving one gentle push to its cradle; and now that it has grown to manhood, it is gratifying to find that the friends of its youth have not been forgotten. Express my thanks to your Council for their gratifying nomination of me."

Herr Julius Schmidt has published a continuation of his reports on the recent Earthquakes in Greece. As Director of the Observatory at Athens, Dr. Schmidt has capital opportunities of studying volcanic action, and in his *Beiträge zur Physikalischen Geographie von Griechenland* for 1869, he has given the scientific world an account of his more recent observations. He thus supplements the published researches of 1861 and 1864.

Sir Samuel Baker has reached Kartoum. Writing under date the 8th instant, he says:—"We have arrived here all well. I found that Gialfa Pasha, the Governor-General of Soudan, had completed all preparations necessary for the expedition, and we expect to proceed within a week with 1,000 soldiers. We are now getting our material ready, and Mr. Higginbotham, the engineer, is coming up with the remainder of our forces."

Dr. Letheby's Quarterly Report on the Quality of London Gas is not without interest, and suggests many questions which we shall not raise just yet. As regards impurity he reports that the gas of all the companies, except the Great Central, has been constantly free from sulphuretted hydrogen; but this impurity was present in the Great Central gas on thirty-six occasions, and was occasioned by unavoidable causes. The amount of sulphur in other forms than sulphuretted hydrogen had fluctuated to a very large extent, for while it was present in the cannel gas of the City Company to the average extent of only 10·29 grains per 100 cubic feet, that of the Chartered Company contained 23·47 grains; and in the case of common gas it ranged from an average of only 12·46 grains per 100 ft. of the Great Central gas to 19·71 grains in the City gas, and 23·73 grains, 24·46, and 29·94 in the Chartered gas, at the three stations of Leadenhall-street, Gray's-inn-lane, and Arundel-street, Haymarket. It is apparent, says the examiner, from the quality of the gas supplied by the City and the Great Central companies, that this important impurity can be kept below an average of 20 grains per 100 cubic feet of gas, and, considering the importance of this matter, it is desirable that the referees should prescribe without further delay the *maximum* amount of sulphur allowable in the gas supplied to the public. The quantity of the third impurity (ammonia) has also fluctuated to a large extent; for, although it has been constantly absent from the City and the Great Central gas, it has been always present in the Chartered gas, and on seventy-one occasions this gas has contained more than the quantity permitted by the referees. On six of these occasions the excess was in the Chartered gas in Arundel-street, on nine occasions in the same company's gas at Leadenhall-streeet, on forty-five at Gray's-inn-lane, and on eleven in the cannel gas supplied by them. Dr. Letheby expresses his satisfaction at the uniformly

good quality of the City Company's gas, and also of that of the Great Central Company, excepting when it was unavoidably charged with traces of sulphuretted hydrogen.

A MEETING of the leading agriculturists of Cambridgeshire was held at the Lion Hotel at Cambridge on Saturday for the purpose of taking the preliminary steps for the foundation of a chamber of agriculture for Cambridgeshire.

DEPUTATIONS from the Universities of Edinburgh and St. Andrews had interviews with the Lord Advocate on Saturday at Edinburgh, and urged that the Government should take measures to improve the burgh schools, so that the students might be better prepared for the universities. The Lord Advocate said he believed some resolution would be come to before the meeting of Parliament, and it should be made known at the earliest date.

WE regret to announce the death of Mr. S. Broome, the well-known gardener of the Middle Temple. Mr. Broome was an eminent practical and scientific gardener, and a Fellow of the Royal Horticultural Society. He died very suddenly on Saturday morning.

THE ladies are at last to have an opportunity of studying anatomy. How improving to modern society the result will be! Of course, none but female subjects will be dissected. Some difficulties having been thrown in the way of the strong-minded women of Edinburgh, the *Scotsman* learns that the Professors of Anatomy of two out of the other Scotch Universities have come forward to offer to the ladies the instruction which is denied them. The Professor of Anatomy in one of the London schools has also expressed his readiness to make arrangements for their instruction in this branch of science.

MR. PIESSE, whose gamut of perfumes is one of the curiosities of science, is trying to encourage the growth of scent-producing plants. The following premiums have been placed at the disposal of the Council of the Society of Arts, for the term of seven years, by Dr. Septimus Piesse, F.C.S.:—1. A premium of £5 for one pound of otto of bergamot, of the value of 16s. or more in the London market, being the produce of plants (*Citrus bergamia*) grown in Australia, New Zealand, Natal, any of the British West India Islands, or any other British colony or dependency. 2. A premium of £5 for one ounce of otto of roses, of the value of 20s. or more in the London market, being the produce of any variety of roses grown together in one plantation in Australia, New Zealand, Natal, any of the British West India Islands, or any other British colony or dependency. 3. A premium of £10 for a canister of enflowered butter or fat, so scented with any kind or sort of flower, either by infusion or enfleurage, or by means of these processes jointly, of the weight of three pounds or more, and of the value of 6s. per pound in London. The said butter or fat to be enflowered or infused with flowers grown for the purpose in Australia, New Zealand, Natal, any of the British West India Islands, or any other British colony or dependency.

IF there is any one thing more likely than another to prevent epidemic diseases, it is the existence of a constant water-supply to the poor and the abolition of cisterns. We cannot, therefore, but condemn, in the strongest terms, the following remarks made by Dr. Whitmore, the Medical Officer of Health for Marylebone, at the recent meeting for the consideration of the water-supply question. Dr. Whitmore stated that—"Sanitary officers would generally say that a constant supply was better than an intermittent one for health; but that would entirely depend upon the mode of carrying it out. A constant supply without cisterns would be most objectionable, and that the abandonment of cisterns was contemplated he concluded from the Report of the Royal Commission, in which it appeared that Dr. Parkes preferred the constant supply, as doing away with the evils of house-storage. He made it his duty to obtain water from fifty or sixty of the worst places in the parish, and it was a *sine quâ non* that it must be taken from cisterns so situated as to be easiest contaminated. It was a fact that he found this water very little worse than that obtained from the stand-pipes of the company. The excess of organic matter was not sufficient to hurt the health of those who drank it. The explanation of this was that the cisterns were really emptied every day, and the water was not in them long enough to be contaminated. The cisterns in the large houses were much more liable to contamination than those in the poor, because the former were constructed on such a scale as to hold large quantities of water for a longer time. If they had the constant supply without cisterns, there *would be a great loss of force*, as there would be nothing but a constant dribbling. In the poorer houses under the present system, through the absence of ball-cocks, the water, after filling the cistern, ran over, and his opinion was, that this constant waste, as it was termed, had been the salvation of the poor. The water that run over thoroughly washed out the drains, and had thus, he firmly believed, prevented many epidemics. The constant dribbling of water had been tried at railway stations, and had failed, as it did not possess sufficient force to prevent the accumulation of solid matter, and the additional resource of flushing had to be adopted. Under these circumstances, the constant supply system would be one of the worst things the metropolis could have. If they could get cisterns large enough for the poor, and get a supply sent in every day, it would be far better." Really, if we did not know Dr. Whitmore's independence of character we should suppose him to be the representative of the water company and not of the public health. His remarks are calculated to do much mischief to the cause of hygiene.

ON Friday a meeting was held at the Town Hall in Rugby, to consider the best scheme for Technical Education. As usual, Mr. Buckmaster—who with a marvellous degree of ubiquity springs up, "Jack-in-the-box" fashion, wherever technical education is being talked about—delivered an address. We should be particularly glad to know what claims Mr. Buckmaster has to be the Mentor of the public on this important point, as also why he is spoken of as the mouthpiece of the Brompton oracle; and further, what his particular ideas are.

EARTHQUAKE shocks are reported from Scotland.

THE question of the Rectorship of the Aberdeen University is still far from settled. Sir W. Stirling Maxwell, though technically elected, has declined the post because the majority of the *students* voted against him, and for Mr. Grant Duff. The students also met on Saturday to consider the position they were placed in by the decision of Sir William Stirling Maxwell, who has declined the Lord Rectorship of the University, to which he was elected. There was also a meeting of the Senate, at which it is stated that it was resolved to take counsel's opinion as to the necessity for, or legality of, a fresh election. Mr. Grant Duff's supporters are to bring forward their candidate again; and if he agrees to stand, there can be little, if indeed any, doubt but he will be re-elected to the chair, which he filled for the last three years. Sir W. Stirling-Maxwell's friends among the students have written to Mr. Disraeli, asking his consent to be put forward for the vacancy. No reply, the *Scotsman* believes, has yet been received from the leader of the Opposition in the House of Commons, and it is generally believed that if any such does come it will be declining the proffered honour. Among other candidates spoken of by the Maxwell party, it is said, were Matthew Arnold and George MacDonald. There is sure to be a contest; but if Mr. Grant Duff stands again he is, according to local opinion, certain of victory.

THE Professors of University College have issued cards for their first annual *soirée*, which will take place at the College on the evening of the 10th prox.

GUNDLACH, the Berlin maker of the cheap immersion object-glasses, has established an agency in this country. We believe

his lenses are optically of excellent quality; and when we say that he sells an immersion $\frac{1}{12}$ in. of 170° aperture at the absurdly low price of £2. 12s., we know that microscopical readers will receive the announcement with wonderment.

The Brighton Aquarium Company has been started. The shares are being quickly taken, and all promises to be a great success. The Aquarium will be under the management of Mr. W. Alford Lloyd, of the Hamburg Zoological Gardens. The scheme has been highly approved of by Professor Owen, Dr. Günther, Dr. P. L. Sclater, and other eminent naturalists. The site of the Aquarium, which will be upwards of 700 ft. long and 100 ft. wide, commences at the toll-house of the Chain Pier, and extends to within a few yards of that structure. On the south side there will be a sea-wall and an approach road, towards which the Corporation of Brighton have contributed £7,000. The most complete arrangements will be made to bring under observation living sea and fresh-water animals and plants of various kinds, and to facilitate the study of their habits and structure. The position, too, of Brighton, enjoying, as it does, the advantage of proximity to the best collecting-grounds in the South and West of England, will present ample opportunities for supplying specimens to establishments of a kindred nature,—a feature in the undertaking which alone may be regarded as an important source of income.

Some time ago, we referred to the introduction of salmon into Tasmania. Since then the colonists interested in the matter declined to believe that the fish found were really salmon. The following paragraph from the *Hobart Town Mercury* decides the question:—"We are glad to report that Mr. Morton Allport has received information from a resident at the falls fully confirmatory of the reality of what some persons are even now slow to believe—that salmon are plentiful in the river, and that young salmon have been observed early in the morning rising in great numbers below the falls. Mr. Allport, from the description given of the fish and their large size, has no doubt whatever that they are veritable grilse." Information has also been received that the tench which were placed by Mr. Allport in the lagoon at the Nile, about seven miles from Evandale, have become so numerous that the people there have been shooting them. As the Nile runs into the Esk, and as Mr. Allport, at the same time, placed tench in several other of the Tasmanian waters, that colony may be congratulated on another addition to its piscatorial family.

An electrical apparatus which has been devised by Messrs. Siemens of Berlin, and which it is intended to employ in the Lower Chamber of the Landtag, might be advantageously adopted in our House of Commons. It would be a great relief to those drowsy members who, roused from their slumbers when a "divide" occurs, rush too often into the wrong lobby. The instrument exhibits, on three different dials, at the moment the vote is taken—1. The votes in favour of the measure. 2. Those opposed to it. 3. The sum of the favourable and unfavourable votes, which serves to check or confirm the previous numbers. Besides this, the instrument indicates on a slip of paper containing the names of all the members, how each of them has voted, and by means of an autographic apparatus any number of copies of this list may be produced with great rapidity. Should it be demanded, the name of each member, and the way in which he has voted, can be made visible by means of a sort of valve, to every part of the house. The mode of employing this machine is the following:—A sort of lever, resembling the lengthened hand of a clock, is placed beside the seat of each deputy. By means of a key which every member receives at the beginning of the session, the hand can be directed to "Yes" or "No," as soon as the President puts the question. The electrical apparatus is worked by one of the ushers of the House by means of a handle.

There is more news of Dr. Livingstone. Just as we go to "press" we find that the Cape papers publish Dr. Livingstone's letters to Sir Thomas Maclear, the latest only being dated Cazembe, July 8, 1868; and also a letter from Dr. Kirk, dated September 7, 1869, which says that Livingstone has found the Nile sources in the lakes near Cazembe, as observed and described by the Portuguese officers Lacerda and Monteiro; but his letter is most unsatisfactory, as it gives no details on this most interesting point.

Relative to Dr. Tyndall's statement in his Friday evening lecture, that cotton wool respirators absorb the organic germs, but permit gases to pass through, an interesting letter appears in yesterday's *Times* from Mr. H. T. Brown. The writer states, as the result of some recent experiments, that cotton wool completely absorbs ammonia gas from a current of air passed through it. Mr. Brown makes also the significant remark, that in the experiments on spontaneous generation which were made by Schroeder and Pasteur, and which were referred to by the lecturer, the cotton-wool filters employed must have prevented all access of ammonia to the organic solutions. This fact, he thinks, and so do we, may have affected the results of the experiments in a manner not calculated upon by these philosophers.

On Friday night Dr. Lyon Playfair delivered a most interesting and instructive address on "Technical Education," before the Edinburgh Philosophical Institution. We shall probably give a report of the address in our next.

An important congress of the Science teachers of Lancashire and Yorkshire was held at Huddersfield on Saturday. The object was to consider the recent minute of the Science and Art Department, to which we referred some weeks since.

ON A CHANGE IN THE COLOUR OF THE EQUATORIAL BELT OF JUPITER.

BY JOHN BROWNING.

FOR several years I have been in the habit of observing Jupiter with considerable regularity with reflectors of large aperture. On every occasion previous to this presentation, the equatorial cloud-belt has been without colour, and the brightest portion of the disk of the planet. During the month of October this cloud-belt has, however, constantly been of a strong, greenish yellow, and darker than the bright belts north and south of it. The colour is almost exactly that known to artists as yellow lake. The colours of various parts of the disk I take from my observatory note-book.

Oct. 9th, 9.30. — Equatorial belt strong yellow lake; the other bright belts colourless. Dark belts very warm grey, and faint coppery red. The poles of the planet ashy blue. The drawing I have the honour of exhibiting represents the planet as it appeared at this time.

Two or three persons quite unused to the telescope noticed the colour of the equatorial belt.

Oct. 11th.—Observed Jupiter with Mr. Proctor. Colours the same, but the greenish-yellow belt was covered with white spots. Mr. Proctor agreed with me as to the greenish yellow of the equatorial belt and the ashy blue of the poles, but could not see the red in the dark belts.

In all instances I used 12 in. aperture and a power of 148, *achromatic* eye-piece.

I have received a letter from Mr. Brindley, of Lewisham, from which I give an extract:—"With reference to the appearance of Jupiter, I last night spent some hours with the $8\frac{1}{2}$-in. telescope turned on him. I was most agreeably surprised; the belts were so different to what I had seen them before. The dark ones of a dark lake colour, the bright one of a lovely tinted green." As this letter was written some days after my drawing was made, and the writer had not seen

the drawing, I cannot be much mistaken in the colours I have ascribed to the various portions of the planet.

Two years since I saw a coloured drawing of Jupiter at Mr. De La Rue's Observatory at Cranford. In this drawing, if my memory serves me, the equatorial belt was colourless.

I have watched the planet through the greater part of a revolution; the greenish yellow of the great equatorial belt remained unchanged. I have drawn the attention of several observers to the colours of the belt, some of whom have been in the habit of observing it for many years. One of these gentlemen says that he is certain that the equatorial belt has not presented such an appearance as at present for a quarter of a century.[1]

Writing to Mr. Proctor some time since, I said that I thought the very small specific gravity of Jupiter might be due to the existence of a cloudy envelope of enormous extent. Mr. Proctor replied that he thought it just possible that the whole light from the planet might not be reflected; but that some portion might be emitted from the body of the planet. The same idea had presented itself to me. Being by far the largest planet in the solar system, it will certainly have retained more heat than the rest.

Such an alteration in the colour of the planet as I have described, must, I think, indicate some considerable change, either on the surface of the planet or in its atmosphere. In the hope of throwing some light on such changes in future, I am making a careful map of the spectrum of the planet. When this is completed I shall have the honour of submitting it to the society. — *Paper read before the Royal Astronomical Society*, Dec. 10.

ON INTERCELLULAR SUBSTANCE AND CUTICLE.

BY W. R. M'NAB, M.D.

AT the meeting of the Botanical Society of Edinburgh held last January, I communicated a paper on the staining of certain vegetable tissues. In it I took occasion to remark that the cuticle covering the external parts of plants could be readily stained with carmine, the so-called intercellular substance remaining colourless. During the year these experiments have been frequently repeated, and always with the same result, namely, that while the cuticle was quickly and deeply stained with carmine, the intercellular substance remained colourless. Careful observation of the growth of cells in the young roots of the white mustard (*Phalaris canariensis*), and the garden pea and bean, have led to the conclusion that the so-called intercellular substance is in reality the original or primary cell-wall—that as growth goes on this primary cell-wall becomes thickened by the addition of numerous more or less marked layers on the inside. In the stems of many plants it requires some care to be able to demonstrate that the cell-wall and thickening layers are separate. In the layer of cells of the epidermis, on which the cuticle rests, the outer surface is in general greatly thickened, while the inner part of the cells is only thickened at the angles at which the other cells join. This thickening at the angles is often so great that the cell appears almost filled up, or the thickening appears as a continuous layer. In the epidermal and sub-epidermal cells of the ivy the thickening is so great that without careful examination the thickening might be considered continuous. On the more or less thickened external surface the cuticle rests, and may be considered as thickening occurring outside the cell-wall. We have many examples of this thickening outside a cell-wall, the covering being analogous to a cuticular layer. As in the extine and intine of the pollen grain, the intine representing the primary cell-wall, the extine the cuticular layer. The intine is the more important part, because the extine may be very thin or wanting, as in the pollen of Zostera. The outer covering of many spores, the exosporium, is also another example of a cuticular layer on a single cell. The so-called intercellular substance, as seen in seaweeds, &c., seems to be a degenerated and gelatinous condition of the cell-wall, and of an entirely different character from that of the cuticle. From all the observations I have made, I think we must reject the statements of Wiegand, Schacht, and others regarding the identity of intercellular substance and cuticle as untenable.—*The Farmer.*

[1] Since writing the above I have received information which leads me to suspect periodicity in the change of colour on Jupiter.

THE DIFFERENT FORMS OF LIGHTS USED IN BRITISH LIGHTHOUSES.

In Two Parts.—Part II.

TO give our readers a general idea of the lighting of our coast as a system, we will ask them to accompany us in an imaginary cruise from the Nore to Dover, noting simply the lights as we go.

We start from the Nore light-vessel, which shows one bright white light revolving at intervals of half a minute. We next pass the Girdler light-vessel, showing a similar light; then the Prince's Channel light-vessel, showing a red light revolving every twenty seconds; and the Tongue light-vessel, which shows two fixed lights, the upper one white, the lower one red.

This brings us to Herne Bay, showing one white fixed light on the pier head; then Margate, with a red light on the pier head; next the Mouse light-vessel, with a green revolving light.

Then the Maplin pile lighthouse with one red fixed light.

The Swin Middle light-vessel, one bright light, with a revolution of one minute; the Gunfleet pile lighthouse, with a red light revolving at an interval of two minutes; the Sunk light-vessel, one bright fixed light; and the Kentish Knock ditto, with one bright revolving light, of one minute revolution; and the Galloper, two fixed lights—these bring us to the North Foreland lighthouse, with tower 78 ft. high, light 184 ft. above high-water mark, fitted with a dioptric apparatus of the first class, showing one bright fixed white light; then the Ramsgate Tide-light, one red and two green lights; the Goodwin light-vessel, three bright white fixed lights; the Gulf Stream ditto, one bright light, with revolution of twenty seconds, to the South Sand Head light-vessel, at the other extremity of the Goodwin Sands, showing one bright fixed light. Next, the South Foreland, with two bright fixed lights, 1,300 ft. apart, until we arrive at Dover, with one green light, two red lights, and one blue light on the Admiralty Pier. It would be tedious to follow this detail further. The sketch we have given may, however, be sufficient to convey an idea of the variety of method and adaptation of light.

In England there is upon an average a lighthouse to every 14 miles of coast; in Scotland, to every 39 miles; and in Ireland, to every 34 miles. In this calculation, however, the light-vessels are not included; and, of course, in the more frequented channels, as in the case just quoted, the lights are much nearer together than elsewhere. On some portions of the Scottish and Irish coasts more lights are certainly required; but as far as England is concerned, the general opinion seems to be that the system of lighting is sufficient and satisfactory. Of the lights under the control of the Board, about 50 per cent. are dioptric, and the remainder catoptric, and of the local lights, about 25 per cent. In Scotland, about two-thirds are on the dioptric principle; and in Ireland, one-third. The consumption of oil has occupied in past days much attention as a question of economy; but the principle has lately most judiciously been adopted of sacrificing this point to the thorough efficiency of the light. Something resembling the French moderator principle is adopted. The oil is supplied to the lamp by mechanical pressure, and it is found in practice that the best light is obtained where the overflow is about three times the consumption.

The old Smalls lighthouse only burnt about 200 gallons of oil per annum. About nine years ago the average consumption at the Start Point and North Foreland was about 500 gallons; but at the present time the usual consumption of a first-class dioptric is 700 gallons. The cost of a first-class dioptric apparatus complete, with lights, apparatus, and lantern, is about £3,000. It is about 9 ft. high and 6 ft. diameter. The second size is about 4 ft. 6 in. diameter; the height in proportion; the cost about £2,200. The third size about 3 ft. 3 in. diameter, costing £1,500; the fourth, 20 in. diameter, costing £400; the fifth, 15 in. diameter, costing £350; the sixth, 12 in. diameter, costing £220.

Combinations of the catoptric and dioptric systems are respectively called the catadioptric and holophotal. Mr. T. Stevenson also invented a light, called the Azimuthal Condensing, the object of which was to direct the whole of the rays down one narrow channel, confining, as it were, the horizon in every direction. The distance to which lights are visible is bounded by the horizon. Sufficient elevation being given, it has been ascertained that in clear weather a first-class light may be visible at 100 miles. Practically, 250 ft. from the water is considered the maximum; this gives a horizon of 18 miles, or 20 miles from the mast-head. When a light is too high it is liable to be obscured by fogs, with the most dangerous results; as a case in point, the light at the Needles may be quoted, which was actually removed from a tower on the top of the cliff to a much lower level, so as to be more readily observed by passing vessels.

The last novelty in pharology is the division of the lantern into sectors of different coloured light. Thus throwing a light of a different colour towards different quarters of the horizon. We will give one or two examples. The approach to the port of Sunderland presents two dangers; the Mill Rock on the one side, and the Hendon Rock on the other, situated at some distance along the coast; it is a dangerous coast in the immediate vicinity of Whitburn, a name connected deservedly or undeservedly with false lights. There are two lights now designed and in course of erection: the upper one, a first-class light, with a one-minute flash; the lower light so arranged that the sector which exactly subtends the Mill Rock throws a *white* beam over that portion of the horizon; while in the sector which subtends the Hendon Rock a red colour is shown. With these guides ships approaching from either direction, by skirting, as it were, the division of the lights, are safely guided to the point where the harbour lights, closer in shore, show the exact entrance. A similar arrangement is made at Caldy, though modified by circumstances; there is a white light out to sea, a red ray or sector eastward, and another red ray or sector westward. By skirting the division of lights west, the shoals off the old Castle Burg are cleared, and the east ray clears the Woolhouse Rock. The anchorage is gained by passing through the red ray at this point, until the fainter white light at the back appears, which defines the safe anchoring-ground.

Another instance, at another port, shows two wide sectors of red light, with a narrow white sector between them, which safely conducts the vessel that follows it to the very mouth of the harbour.—*Builder.*

A Professional Opinion on the "Lichtdruck."—Some specimens of this method of printing, says the *British Journal of Photography*, which we have received from Mr. C. F. Jessen, of Bradford, the English agent for Ohm and Grossman, the inventors, impress us very favourably with the capabilities of this new process. Several months ago some of the continental photographic journals were illustrated by a similar process of printing introduced or invented by Herr Albert, of Munich; but, whether or not it has so happened that we have been fortunate in the case of "Lichtdruck" to obtain exceptional specimens, and equally unfortunate in the opposite direction with respect to those issued by Albert, we cannot say. Certainly, in delicacy and gradation, the specimens of "Lichtdruck" are slightly better than those of Albert.

CHARACTERS OF THE BLOOD IN POISONING BY PRUSSIC ACID.

BY DRS. KEEN AND HARE.

AS the committee to whom was referred for examination the specimen presented by Dr. Packard (viz., a bottle of the blood of Geo. S. Twitchell, jun., who poisoned himself at about 3 a.m., April 8, 1869), we beg leave to report as follows:—

"The blood was carefully examined the same evening, at from 10 p.m. to 1 a.m.—*i.e.*, 19 to 22 hours after death, and at various intervals thereafter. The specimen had been removed from the body at about 4 p.m.

Colour.—When compared with an ammoniacal solution of carmine, it presented but little difference save that it was somewhat more dull and opaque. On examining it by daylight the next morning and comparing it with the carmine, the blood was considerably more of an orange tint.

Smell.—None was perceptible.

Fluidity.—It was perfectly fluid, so that a number of persons wrote various sentences from time to time with perfect ease. It never coagulated.

Blood crystals were obtained with the greatest ease in the usual manner and of no unusual appearance.

Hæmin crystals were easily obtainable also by evaporation to dryness, and then boiling with acetic acid (glacial). These were obtained both before and after decomposition.

Microscopic Examination.—Five different specimens were examined, from both the superficial and the deeper layers with and without shaking.

Red corpuscles were normal in size, *i.e.*, slightly over $\frac{1}{3000}$ in. Some few were crenated. When in thick layer they showed a marked tendency to the formation of rouleaux. On the addition of water they paled and became invisible to the highest power we used, *i.e.*, one-fifth. By 10 p.m., Saturday, the red corpuscles were nearly destroyed.

White Corpuscles.—But few were found singly. Frequent collections, composed of from three to ten, were visible, the nuclei being indistinctly marked. Many of the corpuscles seemed to be losing their defined outline, as if disintegrating. Besides those collections of recognized white corpuscles were others which we regarded as aggregations of disintegrated white corpuscles. They varied in size from three to fifteen times that of a white corpuscle. Their outlines were irregular, and the whole mass appeared to consist of granular matter, in some instances so arranged as to present a radiating appearance. This was most marked when they were slightly out of focus. They were very adherent to the glass, pressure sufficient to cause rapid movement of the red corpuscles not altering their position. The granular margins, however, swayed to and fro, sometimes losing small fragments. In colour they resemble white corpuscles precisely. Some of the masses possessed a relatively darker centre, resembling a nucleus of varying shape, and without defined outline.

Chemical Examination.—Heat applied to the blood produced instant coagulation of the albumen. No test for HCy showed its presence, nor was anything worthy of note observed.—*Paper read before the Pathological Society of Philadelphia.*

Venomous Spider of New Zealand.—At a meeting of the Medical Section of the Auckland Institute, Dr. Wright read a paper on the Katipo, or venomous spider, of New Zealand. The spider, says the *British Medical Journal*, is described as small, with an almost spherical body, and distinguished by a vermilion spot. In a case of poisoning by its bite, which had come under Dr. Wright's care, the symptons were faintness and remarkably slow pulse (fifteen beats a minute). The shoulder which had been bitten showed a large swelling, surrounded by an erythematous blush. Stimulants were freely given, and the man recovered. The meeting enthusiastically determined "that the katipo should be dissected, and the nature of the poisonous secretion tested, with a view to discover an antidote.

THE BANANAS AND PLANTAINS OF THE TROPICS.

POETS have celebrated the banana-plant for its beauty, its luxuriance, the majesty of its leaves, and the delicacy of its fruit; but never have they sufficiently praised the utility of this tropical product. Those who have never lived in southern countries are unable to fully appreciate its value. Some look even with indifference upon the gigantic clusters of this fruit, as they are unloaded from the steamers and sailing vessels; and yet they deserve special attention and admiration, for they are to the inhabitants of the torrid zone what bread and potatoes are to those of the north temperate zone.

The banana-tree is one of the most striking illustrations of tropical fertility and exuberance. A plant which, in a northern climate, would require many years to gain strength and size, is there the production of ten or twelve months. The native of the south plants a few grains, taken from an old tree, in a moist and sandy soil, along some river or lake; they develop with the greatest rapidity, and at the end of ten months the first crop may be gathered, though the cluster and bananas are yet small; but the following year one cluster alone will weigh some sixty or more pounds. Even in the South they are always cut down when green, as they lose much of their flavour when left to ripen or soften on the tree.

The trunk of the tree, if it may be so called, and which grows to a height of some fifteen feet, is formed only by the fleshy part of the large leaves, some of which attain a length of 18 ft., and are 2½ ft. in width. While from an upper sprout you perceive the large yellow flowers, or already formed fruits, you see underneath a cluster, which is bending the tree by its weight.

The plantain-tree is much the same as the banana, with the difference, however, that its fruit cannot be eaten raw, like the banana's, and that it is much larger in size. Almost every portion of the banana-tree is useful. First of all, the nutritious fruit. The plantains, when green and hard, are boiled in water or with meat like our potatoes, or they are cut in slices and fried in fat, when they are soft and ripe. There is a singularity about the boiled plantain, worthy of being mentioned. Pork especially, and other meats are so exceedingly fat in the tropics that they would be most disgusting or even impossible to eat with either bread or potatoes, but the plantain seems to neutralize or absorb all the greasy substance, and the fattest meat is thus eaten by natives and foreigners without the least inconvenience.

Ripe bananas are mashed into a paste, of which the natives bake a sort of bread, which is very nourishing, though somewhat heavy. This paste, which contains much starch, can be dried, and thus kept for a length of time, which is often of great service to mariners. The young sprouts are used and prepared like vegetables, and the fibrous parts of the stalks of the majestic leaves are used, like manilla, for ropes and coarse cloth.

The utility of the leaves is a theme rich enough to fill a volume; they are used to cover the huts, for table-cloths and napkins, or wrapping paper. The dough of bread, instead of being put in a pan into the oven, is spread on a piece of plantain leaf; it will neither crisp nor adhere to the bread when taken out. The Indians of America carry all their products, such as maize, sugar, coffee, &c., in bags made of this leaf, which they know how to arrange so well that they transport an "arroba," or twenty-five pounds, any distance without a single grain escaping, and without any appliance other than a liana or creeper to tie it up with. As to the medicinal qualities of the leaves, they are numerous. Indeed, a book has been written upon them. I speak, however, from my own experience. The young, yet unrolled leaves are superior to any salve or ointment. If applied to an inflamed part of the body, the effect is soothing and cooling, or if applied to a wound or ulcer, they excite a proper healthy action, and afterwards completely heal the wound. Decoctions made of the leaves are used among the natives for various diseases.

Since the beginning of the world this plant has ranked among the first in the flora of Asia. The Christians of the orient look upon it as the tree of Paradise which bore the forbidden fruit, and they think its leaves furnished the first covering to our original parents. According to other historians, the Adam's fig was the plant which the messengers brought from the promised land to Moses, who had sent them out to reconnoitre. It is under the shade of the *Musa sapientium* that, as recorded by Piny, "the learned Indians seated themselves to meditate over the vicissitudes of life, and to talk over different philosophic subjects, and the fruit of this tree was their only food." The Oriental Christians, up to the present date, regard the banana almost with reverence; their active fancy beholds in its centre, if a cut is made transverse, the image of the cross, and they consider it a crime to use a knife in cutting the fruit.

In the holy language of the Hindoo, the Sanskrit, the Adam's fig is called "modsha," whence, doubtless, the word "musa" is derived. It is generally believed that the plant came from India to Egypt in the seventh century; it still forms a most important article of commerce in the markets of Cairo and Alexandria. In the year 1516, the banana was brought to the West Indian Islands by a monk, since which time it has rapidly spread over the tropics of America, and is found to the twenty-fifth degree north and south of the equator. It is equally indispensable and is appreciated by the immigrant and by the native as a beautifier of the landscape; affording shelter from the sun and rain, and giving bread to the children; for if every other crop should fail, the hungry native looks up to the banana-tree, like a merchant to his well-filled storehouse.—*Scientific American.*

SILKWORM CULTIVATION IN ENGLAND.

BY ALEXANDER WALLACE.

PUBLIC attention was directed to the cultivation of the mulberry silkworm in this country by the paper recently read before the Society of Arts by Thomas Dickens, Esq., President of the Silk Supply Association. Allow me to add a few remarks on this most important subject, which I trust will be at once thoroughly investigated by practical experiment over extended areas in Great Britain. It is needless to remark that could such an industry as that mentioned be introduced, it would confer an enormous benefit on our agricultural and manufacturing population, especially on women and children; we may, therefore, find it worth while to reopen the subject, which has lain dormant for the last forty years, and reconsider if the experiment, which was then abandoned as only partially successful, may not now be revived with more chance of success. Referring to the last experiment in mulberry silkworm culture, we find it stated in Dr. Lardner's *Cabinet Cyclopædia*, "Silk Manufacture," p. 40, published in 1831, that "In 1825, a company was formed, under the title of the British, Irish, and Colonial Silk Company. This undertaking was supported by characters of the highest rank and respectability, many of whom were induced to give their countenance to the project by a patriotic desire to ameliorate the condition of the Irish peasantry, by adding to their profitable sources of industry. A royal charter was obtained; about eighty acres of land in the county of Cork were planted with nearly 400,000 white mulberry-trees. The whole proved unusually successful, very few trees having died, and many, in the first year of their transplantation, put forth shoots 20 in. in length. A small but complete building for rearing silkworms was adopted on the plan of Count Dandolo.

The experiment was repeated on a more limited scale in England. Between 70,000 and 80,000 mulberry-trees were planted in nineteen acres of fine rich soil, near Slough. The trees flourished here as well as in Ireland. But the attempt to rear silkworms has been ultimately abandoned by the company. Its managers now turn the whole of their attention to an establishment in the island of Malta. The experience of the company leads to the conclusion that if our moist and variable climate do not in itself offer a sufficient obstacle to the success of attempts at rearing the silkworm, there would still remain another objection—viz., the high price of labour. Silk requires so much care and attention for its production, and so great a number of persons must be employed in an establishment for rearing silkworms, that it is only in countries where the poorer class is great in proportion to capital, and where, consequently, labour must be extremely cheap, that the silkworm can be reared at any expense which offers successfully to compete with other regions. Even then the superior skill and knowledge of people to whom the silkworm has been long an object of attention will always insure them a superiority over novices in the art. The ignorance and awdwardness of the Irish peasantry in bestowing the necessary attention upon the silkworms afforded sufficient reason for rendering their employment unprofitable to the growers." But since 1825, great changes have taken place in this country and its people. 1. Land has been more thoroughly drained, woods and trees cut down or greatly thinned, and the result is a warmer, drier atmosphere, of which the last item is the most important in mulberry silk-culture. 2. The general intelligence of the country has increased. We have now no difficulty in finding skilful and intelligent hands among the working classes. 3. Interchange of ideas, and of communication between distant countries, as also among ourselves, is now effected with rapidity and certainty; and most approved methods of cultivation, the most skilful treatises, the healthiest eggs may easily be obtained from sericiculturists of repute in all parts of the world. Even now a Japanese pamphlet, on the culture of their mulberry silkworm, printed in August, 1869, at Yokohama, has just been published in the *Guide to Sericiculture*, issued by the Silk Supply Association. We approach, therefore, the practical part of the subject with much greater facilities than we possessed in 1825. The objections raised by Dr. Lardner are easily disposed of. 1. With regard to climate—In a magnanerie (or house for rearing silkworms), properly fitted up with modern appliances for regulating the temperature, ventilation, and hygrometric properties of the air, the thermometer and hygrometer may easily be maintained in our climate at the required point, in the months of May, June, and July, without in the least interfering with the necessary amount of ventilation required, and entirely independent of external atmospheric influences. Forty years ago, this, I apprehend, was impossible. 2. The high price of labour, and the number of persons required in a magnanerie, is cited as an obstacle. The rate of wages of the present day in agricultural districts cannot be pronounced high, especially that of women and children, who would be largely employed in tending silkworms; the price, moreover, of silk is relatively now much higher than it was forty years ago. Recent improvements have also greatly minimized the labour required, not merely in reeling the cocoons by aid of machinery, but also in feeding the worms. 3. The third objection—viz., the ignorance and awkwardness of the peasantry of that day is worth but little now, owing to educational and other changes; the intelligence of the peasantry is far greater now than then, and the fact that there is no lack of skilful and intelligent hands in the manufacturing districts, will go far to prove that awkwardness and ignorance need not now impede the culture of the silkworm. Furthermore, Mr. Dickens's position with reference to the culture of the silkworm in Great Britain is fortified by the opinion of French sericiculturists of known repute. M. Taurigna has stated that we have many localities well suited for the production of seed (eggs), and that we ought to take the highest rank of all European seed-producing countries, our cool climate being especially favourable to the development of sound and healthy races. M. Guérin-Méneville, Inspector-General of Sericiculture in France, writes to me as follows:—

"Aujourd-hui il est reconnu que l'elévage des vers à soie peut se faire avantageusement dans des pays tempérés, et même froids, et non exclusivement dans le Midi; et l'on commence à dévellopper cette riche industrie dans les départements du Centre et du Nord, dont le climat est peut-être plus rigoureux que celui de l'Angleterre. Je crois que vous parviendriez facilement à dévellopper cette industrie chez-vous et qu'elle y donnerait de très bons resultats. Pour cela il faut que quelques proprietaires aises et riches donne l'exemple à fin que les gens des campagnes le suivent."

This opinion, coming from a man who has devoted himself entirely to sericiculture, has published most valuable writing on the subject, and who travels, by virtue of his office, yearly, during the silkworm season, over all the silk districts of France, and reports thereon to the Ministre d'Agriculture, seems to me to be the strongest *à priori* authority that could be cited for again experimenting in silk-culture in England. But, fortunately, we have additional evidence that, so to speak, clinches the matter. For the last three years, Captain Mason, in the vicinity of Farnborough, has, in his magnanerie, reared a thoroughly healthy stock of silkworms of the *B. mori*, obtaining cocoons and silk equal to the best Italian produce. Those which were exhibited at the meeting have been deposited at the offices of the Silk Supply Association, 3, Castle-street, Holborn, and were pronounced most excellent by the members of that association, who were well fitted as manufacturers to express an opinion thereon. When submitted to the judgment of the working men at Macclesfield, the only regret heard was that there was not enough of it to work in the loom. Captain Mason has not hitherto been able to furnish us with statistics of the quantity that can be produced from an acre of ground; for this we must wait another year or two, but he informed me that as far as he could judge, from his experience of the last three years, after all expenses had been paid, a profit of £10 per acre, on a plantation of 100 acres, might easily be realized. Captain Mason is a thoroughly practical man, who has, without enthusiasm, tested the feasibility of silkworm culture on about three acres of ground, planted with the white mulberry-tree; his magnanerie is a model of cleanliness, and his devices for preserving the requisite ventilation and temperature are perfect. Were he to turn his attention to the production of healthy seed, instead of cocoons, he could easily make a large profit thereupon. It is chiefly in this direction that I advise that the first efforts of experimenters in sericiculture should be directed. The scarcity, and consequently the high price, of sound eggs (owing to the ravages of the epidemic disease during the last fifteen years), has brought it to pass that in all countries silkworm eggs are eagerly sought for. In Japan, four years ago, cards of eggs, weighing on an average 5-6ths of an ounce each, sold for 1s. 6d. a-piece; then a rush was made to Japan for eggs. In 1865-6 2,000,000 cards were sold; in 1868-9, 2,500,000 were sold, at prices varying from 12s. to 15s. per card. This season, as I learn from a friend in Japan, has been unusually bad, and the quantity of cards is 500,000 only. The natives are holding out for long prices. The cards this year have reached 5 dols., or 21s. 8d. each. At 5s. per oz., which ought to be the normal price, it would pay to grow eggs for sale; at 21s. per oz., the profit would be very great. Of course this price cannot be upheld as soon as competition comes into play; but for beginners in sericiculture it will be a great encouragement to get a good price for their eggs. I could urge further reasons for upholding Mr. Dickens's proposition to attempt a new sericiculture of the *B. mori* in Great Britain, but I think I have stated enough for the present purpose of promoting inquiry and experiment. I

will now conclude with a few remarks on a portion of the subject not referred to in Mr. Dickens's lecture. Other races of silk-producing insects have been introduced into Europe with a view to a trial of their produce and acclimatization. Of these the ailanthus silkworm, and two or three kinds of oak-feeding silkworms, are all we have made trial of. The ailanthus silkworm may be dismissed from present consideration, for, though easy to rear, and thoroughly acclimatized, the cocoon cannot at present be easily reeled in a remunerative way. The oak-feeders from China and North America have been tried only for one or two seasons, and we cannot yet speak confidently about them. The oak-feeder from Japan, the *Bombyx yama-mai*, which was at one time monopolized by the Royal family, and considered so precious, that the penalty of death was threatened on any one exporting its eggs—was introduced into Europe in 1863, and though a considerable check has been experienced in its culture, one individual, most successful from the first, has achieved a marked success. M. le Baron de Bretton, of Vienna, beginning five years ago with a few eggs, has this season reared the *Yama-mai*, in the oak woods on his estate, to such an extent that 27,000 cocoons were set apart last autumn for the production of healthy and acclimatized eggs. In reply to an inquiry as to his method of rearing this valuable silkworm, he stated that he was the possessor of certain secrets which enabled him to rear the worm with certainty, but which he declined to part with, except for a pecuniary consideration. Specimens of his cocoons and silk will shortly be in my possession, and will be submitted for inspection at the offices of the Silk Supply Association. In England, the experiences of raising this silkworm, in 1868, resulted in failure, chiefly owing to the hot summer. In 1869, failure again ensued, chiefly from the cold months of May and June. In both years cocoons were obtained only from worms that had been reared indoors. The experiences of the past three years seem to prove that the comparatively cool and moist climate during June and July of our western and northern coasts, are better suited to the culture of the *Yama-mai* than the dry hot temperature of the southern and eastern counties. Thus, in the south of Ireland, in Wales, Herefordshire, and western part of Scotland, a much greater amount of success has been recorded than elsewhere. It is also found by experience that they do best in a freely-ventilated room, shaded from the sun, the temperature about 70°, equable, and rather moist. Sunshine and a dry heat of 80° seem highly injurious. Great cleanliness is essential. I incline to the belief that the experience of a few more seasons will indicate to us the limits of temperature and locality wherein the worm may be successfully acclimatized, and that it eventually may become a denizen of Great Britain.—*Journal of the Society of Arts.*

Dr. Schweinfurth's Travels.—The *Athenæum* says that letters have recently been received in Berlin from the well-known German traveller in Africa, Dr. Georg Schweinfurth. Since the appearance of his earlier works (*Plantæ quædam Nilotic*æ, 1862, and *Beitrag zur Flora Æthiopiens*, 1867), Dr. Schweinfurth has held a high rank among German botanists. Leaving Cairo early in 1864, he travelled along the western coast of the Red Sea, and after returning to Cairo made a second visit to the same region, extending his journey to Abyssinia; afterwards, travelling westward to the Blue Nile and Khartoum, and northward to Cairo, he completed his first journey in Africa in 1866, having spent much of the time at places of interest on his route. The results of this journey were so important, both for general science and for the branch which he had made his speciality, that on his proposing, at Berlin, a second visit to Africa, the "Humboldt Fund for Scientific Investigation and Travel" was placed at his disposal. He started from Suez in August, 1868, partially retraced his former route, and arrived in October at Khartoum, from which place, assisted by an agreement with the trader Ghattas, he travelled to the latter's trading-settlement on the Bahr el Ghasal, the principal western source of the White Nile: and here he established, in March, 1869, his head-quarters for journeys in the surrounding country. In April and in December, 1869, botanical and other collections made by him reached Berlin, accompanied by full accounts of his journeys, and by scientific treatises, which will soon be published.

WHAT PHOTOGRAPHY DID IN 1869.

A RETROSPECTIVE glance over a year's history is always interesting and instructive, and it is pleasant to add, in relation to the twelve months just completed, the examination affords several sources of satisfaction. In many respects the photographic year has been marked by distinct progress. During the three decades which have elapsed since its discovery as a practical art, it has seen many phases of change and advancement. But of late the keen thirst for novelty, the eager interest in experiment, of a sometimes vague, and not unfrequently empirical character, has largely passed away. But whilst new processes are less numerous, the tendency of experiment, it is satisfactory to note, is to secure practical ends. In the actual discoveries of the year there is real gain, and the domain of photography has been both enriched and extended.

Of primary importance is the advancement made in permanent printing. The old and just reproach of photography, the unstable character of its productions, has lost its force. Apart from the improvements made in methods of silver printing, whereby increased permanency is secured, various methods now exist of obtaining photographic impressions, lacking no point of excellence, and of absolutely unchallengeable stability. Chief amongst the improvements of the year in this direction is the improved carbon process of Mr. Johnson. A few years ago Mr. Swan made perfect carbon printing in half tone commercially practicable; this year Mr. Johnson has made it easy and cheap, without sacrificing any jot of beauty or excellence, and we may add, still greater improvements in the process will shortly be announced in our columns. Mr Window has announced the discovery of another method of producing carbon photographs, which for special purposes possesses great promise, and is, we understand, unusually simple, and easy in practice. The publication of Mr. Blair's pamphlet must have given fresh stimulus to many carbon experimentalists, although, as yet, we have heard but little of their labours. The method of producing carbon pictures without transfer, by means of a tissue rendered temporarily transparent at the back, first suggested by Mr. Swan some years ago, has appeared twice during the year as an independent discovery; it has been published by Mr. Blair, and included in a specification by Mr. Pouncy. The examples of work done in this way with which we have been favoured by Mr. Blair have suggested that for amateur purposes this plan possesses many advantages.

Photo-mechanical printing processes have made great progress during the year. The results of Herr Albert, of Munich, by a method analogous to photo-lithography, in which a layer of bichromated gelatine exposed under a negative acquires the property of repelling water, and receiving a coating of fatty ink, in the exact ratio of the action of light, far surpasses in excellence anything hitherto produced by analogous modes of printing. The process, so far as we can learn, is essentially practical, and the plates yield a large number of impressions. The success of Herr Albert has stimulated many other experimentalists in a similar direction, many of them with considerable promise, but none at present nearly approaching in excellence to the most successful of the Albert-types. In photo-block printing Mr. Dallas has continued to make progress, and has produced some very good results in line and stipple. Photo-block printing of subjects direct from nature does not appear to make progress, nor at present to afford much hope of success. A new process of photo-mechanical printing, by Messrs. Edwards & Kidd, the details of which have not yet appeared, seems to possess considerable promise. Mr. Woodbury's method of photo-relief printing has made some progress, and maintains its distinctive excellence, amongst photo-mechanical processes, of producing the most perfect analogue of the sun-picture proper, which has ever been obtained by mechanical means.

Ceramic photography has excited considerable attention during the year, and various experimentalists have been engaged upon it. Mr. Henderson has attained the highest excellence in this country, many of his enamel miniatures being absolutely perfect in delicacy, force, gradation, and tone. His method, however, remains a secret.

Silver printing processes have made some progress, less in relation to results than to means. Permanent sensitive albumenized papers of real excellence have taken a place in commerce, and offer many advantages, especially to amateurs. Collodio-chloride printing has made some progress; the method of fuming the film has been found a valuable improvement. Camera-printing on wet collodion has been successfully practised during the year.

The ordinary wet collodion negative process has not undergone much change during the year. Some attention has been given to the use of alkaline or neutral nitrate baths, as a means of attaining increased sensitiveness, and negatives which do not require intensifying. Mr. Blanchard has secured some very encouraging results in this direction. The use of washed wet plates has continued to be successfully practised. The golden syrup solution, for preserving plates moist exposed and developed in the field, with a view to finishing at home, has also come into more general use.

In dry-plate processes there has been but little change. The gum-gallic process of Mr. Gordon has become the general favourite, and has yielded, in the hands of many photographers, very fine negatives. Mr. England has used it extensively during the summer, and has brought home from Switzerland some hundreds of very fine negatives by it. There is strong general testimony to the excellent keeping qualities of the plates; but Mr. England expresses a decided conviction that these, in common with every kind of dry plate, deteriorate from the time of their preparation. The gum-gallic plates exposed fresh, he found, gave good results with an exposure of twice as long as that required for wet plates; but at the expiration of a week the exposure required considerably increasing, and under such circumstances developed better with alkaline pyrogallic solutions than with the iron solution recommended by Mr. Gordon. The coffee process has also received some attention during the year, and M. de Constant has found that with the addition of gum excellent results are obtained. Mr. Sutton announced a new alkaline process, having some analogy to Mr. Bartholomew's gelatine and carbonate of soda process. In the recent process, the alkaline conditions are more thoroughly carried out, and alkaline development employed. The process was somewhat complicated, but gave hope of sensitiveness. No trustworthy reports of its successful application have reached us.

The impulse given to photographic portraitists a couple of years ago by the exhibition of the works of M. Adam-Salomon has continued, and borne good fruit in the higher art qualities which have distinguished the works of many of the portraitists in this country, the especial class of portraiture which has been designated as Salomonesque having come extensively into vogue, with, however, in many cases, sufficient modification to stamp the individuality of each producer upon his pictures. The pleasing new style of portraiture introduced by Mr. Sarony, and named photo-crayons, has attracted considerable attention, and has been largely in demand.

The very successful exhibition of the Photographic Society, held in November, afforded ample illustration of the advance of art-qualities in various branches of photography. The practice of combination printing, as one of the aids to increasing the plasticity of photography, steadily increases in the hands of photographers who aim at the production of pictorial effect, notwithstanding the strange abuse which the system has received, both from capable and incapable writers, who inveigh against it as of necessity untruthful. These writers overlook the fact that truth, in any form of art, depends rather on the capacity of the artist to perceive and embody truth, than on the mechanical means—whether pencil, camera, or printing-frame—by which the truth is embodied. The most perfect mechanical means may fail to render truth in incapable hands, and thus the simplest form of photography be made false and misleading; whilst, in the hands of a cultivated and conscientious artist, combination printing will always be kept under the governance of art truth.

Photography gradually takes its place more firmly and widely as a recognized branch of economics. Its applications are more numerous, extensive, and valuable, and, in many respects, its commercial prospects are improving.

The societies generally are flourishing, but some have ceased to meet, and the North London has ceased to exist. It had done good service during many years, but gradually declined, having, as its committee concluded, done its work. The Photographic Society of London and the South London Society are active and flourishing.

Death has removed some veterans in the art. Mr. Roger Fenton, one of the earliest and most successful photographers, and the practical founder of the Photographic Society, died during the year; Mr. Hockin, an early photographer and skilful photographic chemist, also died; Mr. Petschler, a gentleman whose name was familiarly known amongst dry-plate workers, died also.—*Photographic News.*

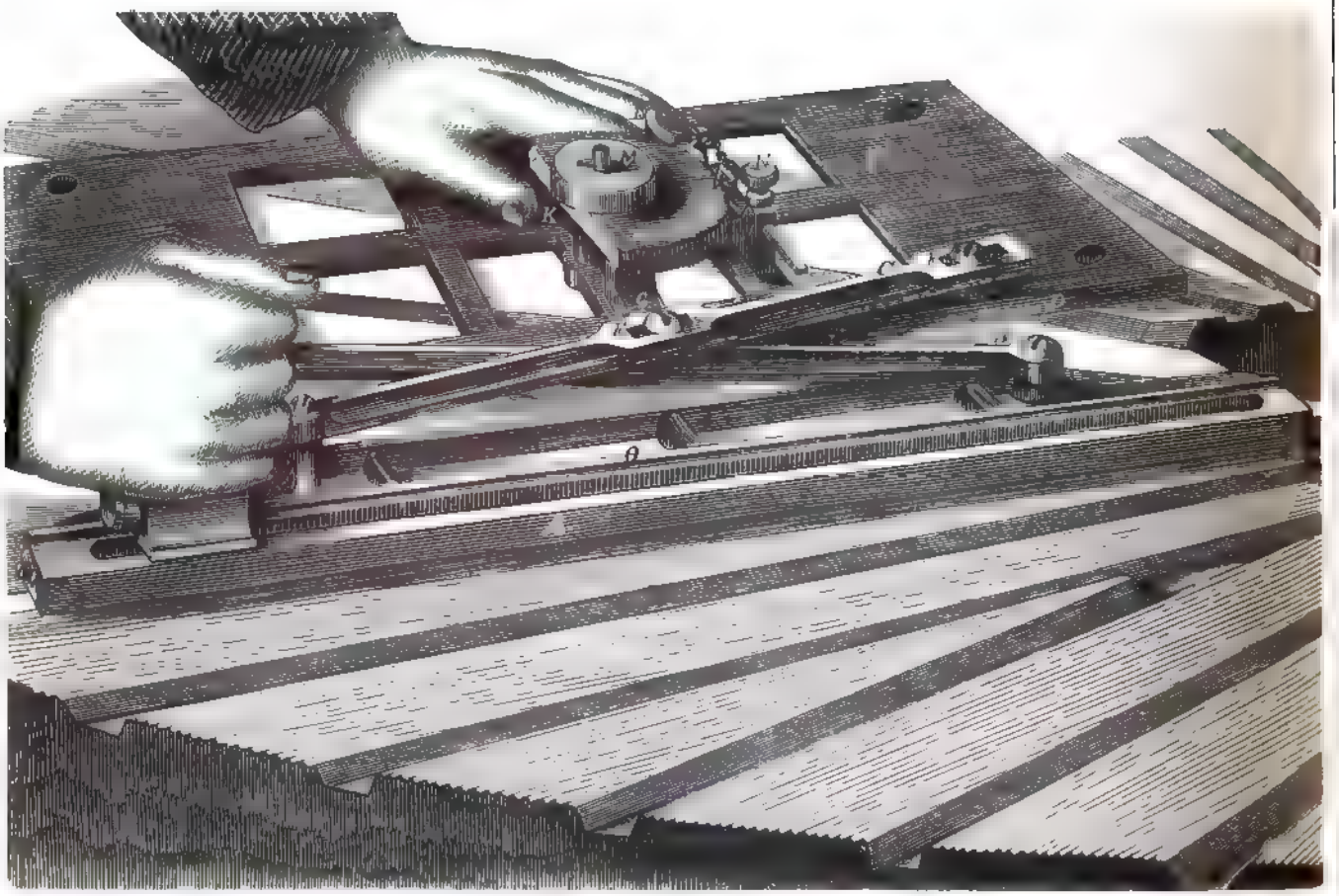
DRESSING MILLSTONES BY THE USE OF THE DIAMOND.

MILLERS who may be unacquainted with the nature of diamonds or their durability, it is reasonable to suppose, will be somewhat sceptical and incredulous as to the practicability of using them successfully as an economical application in dressing the lands of millstones. But if they would take the trouble to investigate their history and the purposes for which they are, and have been, employed besides that of ornaments, they will learn that they were used before the Christian era, and up to the present age, for making lines of any depth or form, and for carving faces and figures in relief upon the hardest class of stones, such as the onyx, and others which are almost as hard as the diamond itself. Again, diamonds are now being used successfully for drilling, sawing, planing, turning, shaping, carving, and dressing stones or other hard substances.

Diamonds set in an ordinary stem or ferrule were tried many years ago in Europe (and recently in America) for producing lines upon millstones, and the millers were perfectly satisfied that the finest and most effective dress was attained by merely gliding the diamond lightly over the stone. The use of diamonds for this purpose was abandoned, however, from the difficulty in keeping them in their setting, and the liability of their being broken by over pressure. It was universally conceded, that if the diamond could be set sufficiently firm in an instrument, so constructed as to regulate the pressure and protect it, it would eventually in a great measure supersede the pick.

After many experiments and trials, Mr. Dickinson has succeeded in constructing the important improvements illustrated in our engravings, the success of which is attested by those using the machines for over six years. The main difficulty he found was in educating millers to the proper handling of the diamond, and overcoming prejudices against any innovation upon the old mode of dressing with a pick. From their habit of seeing so much stone displaced, it had become an idea or conviction with them that such displacement was actually necessary or unavoidable, and it has taken some time to convince them of the contrary.

The large engraving [p. 92] represents Mr. Dickinson's patent graduated guide. A double rule, *A*, is connected to a straight edge, *D*, by two transverse arms *B* and *C*; the arm *C* having slots, *E* and *F*, cut in the centre and the right-hand end to



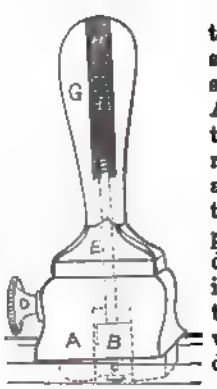
DRESSING MILLSTONES WITH THE DIAMOND.[1]

accommodate the motion in drawing the arms in a direct line with each other towards the straight edge, *D*, which is done by the revolution of a small roller in a spiral cut in the wheel *H*. This roller is screwed on a projection *G*, attached to the middle of the lower arm *B*. The wheel, *H*, has also cut on its edge granulated teeth in which a pawl, *I*, is made to catch, propelling the wheel around when actuated by the thumb-piece, *K*, with the pressure of the thumb of the left hand, and it is sustained in its position by a pawl, *L*, as the pressure is continuously repeated. The box, *M*, contains a spring which throws the double rule, *A*, back to its former position when relieved from the pawl *L*. On a raised ledging of the bed-plate, *P*, there is a graduated scale with figures, to enable the operator to set his distances as he may require between each line, which is done by a short sliding bar secured by a screw, *G*. *O* is a raised ledging on the inner rule which guides and steadies the protector in its motion. The spiral movement described is attached to the bed-plate *P* (the lattter being planed level), and is adjustable upon the face of the stone as may be required.

In using this guide the operation is very simple, and requires but little practice, the guide being so constructed as to produce the distances between each crack mathematically correct. It can also be set by the scale so as to obtain any number of cracks to the inch from eight to forty-eight.

When using this instrument, the palm of the left hand is pressed firmly upon the bed-plate, *P*, on which the movement is fixed, and, after having marked with the diamond as often as required, the thumb-piece, *K*, is pushed by the thumb of the left hand as far as it will go, then immediately relieved.

This pressure is repeated until the back of the double rule touches the straight edge, *D*, when the forefinger of the left hand presses the pawl, *L*, and the spring in the box, *M*, then instantly extends the double rule to its first position.



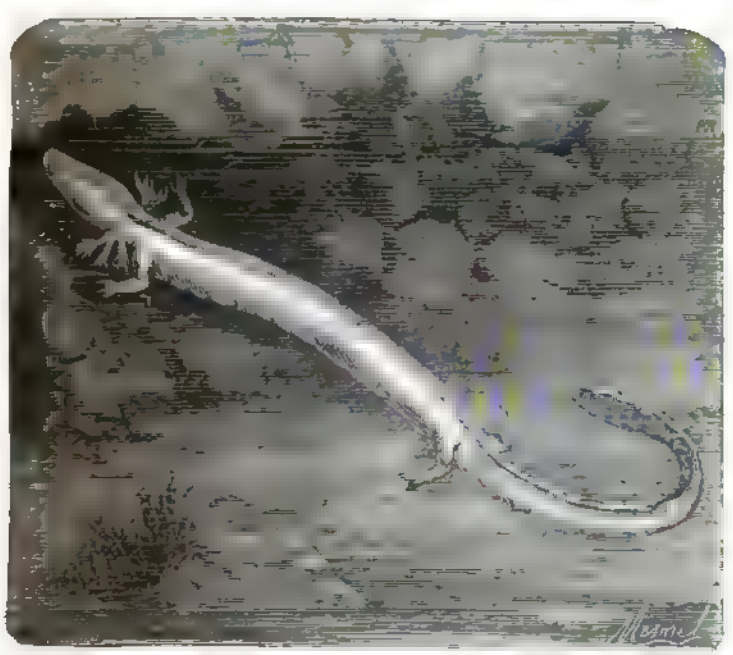
The small diagram shows the construction of the "protector." A represents the stock or protector, in which is inserted a steel bar, B, containing the diamond C. A is a shifting guard, upon which the protector is made to slide between the double rule or tramway. This guard is adjustable, and secured in its position by a thumb-screw D. E is a rod which is pressed upon the bar, B, containing the diamond, C, by a spring, which pressure is increased or diminished by a screw, H, at the top of the handle, G, in accordance with the nature of the burrs and depth of dress required.

This protector is drawn through the double rule or tramway, the same as a pencil in ruling a slate. The operation is so simple that a boy could operate with it blindfolded.—*The Artizan.*

[1] The block has been kindly lent by the Editor of the *Artizan*.

SUBTERRANEAN RIVERS.

The Styx, a Subterranean River in the Mammoth Cave, U.S.



The Proteus of the Subterranean Rivers of Carniola (Proteus anguinus, Laurenti).

REVIEWS OF BOOKS.

The Universe; or, the Infinitely Great and the Infinitely Little. By F. A. Pouchet, M.D., Corresponding Member of the Institute of France. Translated from the French. London: Blackie & Son. 1870.

M. POUCHET has realized what Popular Science should be, and has given us a treatise on Nature generally, which is unquestionably the finest work of the kind ever published in this or any other country. The author's object in writing the book was to extend to the utmost of his power a taste for Natural Science, and in the preface he admits that his book is not "a learned treatise, but a simple elementary study, conceived with the idea of inducing the reader to seek in other works for more extensive and more profound knowledge." The volume is, in point of fact, a magnificent landscape of natural phenomena. Everything is Turneresque and broad and grand; there is no taint of pre-Raphaelitish detail about it. To give an idea of the multitude of subjects dealt with by the author we quote the following headings of the several "books" into which the work is divided. These are—the Invisible

World; the Architects of the Sea; Insects; Ravagers of Forests; Protectors of Agriculture; the Architecture of Birds; the Migrations of Animals; the Anatomy of Plants; the Physiology of Plants; the Seed, and Germination; Extremes in the Vegetable Kingdom; Migrations of Plants; Formation of the Globe; Fossils; Mountains, Cataclysms, and Upheavals; Volcanoes and Earthquakes; Glaciers and Eternal Snows; Caverns and Grottoes; Steppes and Deserts; the Air and its Corpuscles; the Stars, and Immensity; the Solar World; and, lastly, Monsters and Superstitions.

Indeed, it will be apparent that M. Pouchet's volume is, as its title indicates a history *de omnibus rebus et quibusdam aliis*, in so far as concerns the objects usually embraced by the study of Biology. Perhaps it would have been wiser had a more limited area been chosen, but with such a field before him—a field, too, in which he himself has done so much, and such good work—M. Pouchet has achieved all that could be done in justice to each department he has handled; and being master of a literary style such as very few scientific men possess, he has written one of the most attractive and graphic chronicles of Nature's operations which we have ever had the fortune to meet with. Here and there we notice passages and illustrations which have been inserted, we should say, in the exercise of poetic or artistic license rather than from a conviction of their veraciousness. This we regret; it was to have been avoided if possible, but we presume that M. Pouchet, on the whole, gives a grain of credence to the statements of the kind which his book contains, else we should not find him giving a description of the gigantic cuttle-fish seen in 1861, off the Canaries, by the captain of a French vessel; and, on the same ground, we would explain the appearance of a handsome engraving illustrating this huge "polypus," which is here made almost as large as the steamer, which apparently, as a matter of precaution, is giving the monster a "wide berth."

There are, however, very few such defects in this magnificent volume. *Tout au contraire*, the facts narrated are well established, and the illustrations, many of which are exquisitely coloured, are such as have never before appeared in any treatise on science. The engravings are so numerous that it is hardly possible to open any of the nearly 800 pages of which the work consists without coming on some elegantly-designed and well-printed woodcut. Of the other mechanical features we can truly say that, in binding, paper, and typography, the publishers have spared no expense, and have in consequence produced a book which in point of luxurious ornamentation cannot be surpassed.

Of the contents of the work there is not much to be said critically: the mere outlines of natural history have been sketched. But there are some of the chapters which contain matters not hitherto brought before the English reader of popular scientific books. Of these two are particularly worthy of notice—those on "the air and its corpuscles," and on "monsters and superstitions." Both these chapters will be read with interest by educated persons of even average intelligence. In the first, the author, who we need not say is the well-known advocate of the doctrine of spontaneous generation, indulges in a telling diatribe against M. Pasteur and the other modern supporters of panspermist doctrines. And, in our opinion, M. Pouchet has by far the best of the argument; for, so far as positive facts go, all are on his side, and none on M. Pasteur's. Hear what M. Pouchet says in regard to the supposed universal presence of organic germs in the air:—

"There are plants which only appear under circumstances so exceptional and so extraordinary, that the mind revolts at the idea of their tiny seed loading the atmosphere century after century in order at long intervals to fertilize some imperceptible part of the globe. This would be inutility in immensity. A fungus is known which never grows except on the bodies of dead spiders. Another only appears on the surface of horses' hoofs in a state of putrefaction. One little parasite of the same family—the Isaria of the Sphinx—has hitherto only been observed on certain nocturnal moths. The chrysalides and larvæ of these are never attacked by it; other species infest them. Unless one possessed the imagination of a Bonnet is it possible to suppose that Nature would uselessly have burdened the air of the whole globe for the mere purpose of scattering seed on the bodies of a few spiders and moths; and that there was always a stock ready for the perfect insect, its chrysalis, and its larva? Still more curious facts are known; for instance, that of a fungus never found but on the neck of a caterpillar of tropical countries. It is always solitary on this, and of enormous size in proportion, being often four to five inches high."

M. Pouchet's argument as to what Nature would or would not do is, of course, of no scientific weight, as we know that Nature is horribly wasteful of her organized products, but there are other facts in this chapter which the panspermists never can fairly get over.

The chapter on Monsters is a most unique and curious account of the strange creatures described as actual entities by the older writers, and especially in the works of Albertus Magnus, Aldrovandus, and others. The illustrations are bizarre and amusing examples of the credulity of our forefathers. The account of the Grottoes and underground caverns of different parts of the globe are brief, but are singularly interesting, and are accompanied by some engravings of remarkable beauty, two of which, one representing the Mammoth Cave, and the other the curious Proteus of Carniola, we have been enabled through the courtesy of the publishers to reproduce (see p. 93). Altogether the book is most praiseworthy, and the translator, whose name is not given, has done his part of the work with very great skill and carefulness.

The Body and Its Health: a Book for Primary Schools. By E. D. Mapother, M.D. London: Simpkin & Marshall.

DR. MAPOTHER, the Professor of Physiology in the Royal College of Surgeons of Dublin, has here given us a very elementary school book on general physiology and its application to practical hygiene. The style and plan of the little volume are excessively simple, except in a few occasional passages, where the author expresses his opinions of the duty of the State to the people—not the sort of thing most intelligible to young, very young, folk at school. The volume is worthy of commendation, and we hope some of our primary schools will adopt it.

The World we Live in, or First Lessons in Physical Geography. By D. T. Ansted, M.A., F.R.S. London: Wm. Allen & Co. 1870.

WE object to the use of the term physical geography, but we presume that while it is recognized by scientific men, books written on physical geology and the distribution of life must bear the title of physical geographies. The small volume now on our table is a companion to that on the earth's history reviewed in our last issue. It is not so successful a work on the whole, but is, for all that, a useful school book and a cheap one.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

Dr. Molloy on the Bible and Geology.—*From* Dr. Molloy.

Sir,—I do not mean to trouble you with a defence of my work on *Geology and Revelation* against the critical remarks that appeared in the last issue of your journal, but there is one error into which the reviewer has fallen, which I trust you will allow me to correct, as it seems to involve a charge of dishonesty. It is alleged that I have "ignored" the geological evidence which bears upon the antiquity of the human race, and, a little further on, the writer hints, clearly enough, that I have done this for the purpose of misleading my readers, inasmuch as the evidence in question is unfavourable to my cause. He says, "treatises like that of Dr. Molloy, in which the Bible is made to tell the required story, and in which *so much of scientific truth as is demanded is told and no more*, are the stepping-stones of scepticism."

Now I have distinctly stated, in my introductory chapter, that there are two points of contact between geology and revealed religion, the one being the antiquity of the earth, the other, the antiquity of the human race. The first of these two points I take for the subject of the present volume, and, in the last paragraph of my book, I announce my intention of discussing the second, as soon as I can find leisure and opportunity. This being so, it is plainly not quite fair to say that I have "*ignored*" the geological evidence for the antiquity of man, much less is it fair to insinuate that I have dishonestly suppressed it.

The reviewer maintains that the omission of this evidence is "a deep flaw in Dr. Molloy's argument, and one which indeed renders his reasoning absolutely without foundation." I regret he should entertain this opinion, and I have little hope of converting him to my views, but I may be allowed to observe that the antiquity of man not being the subject of this volume, the evidence by which it is supported was not pertinent to my purpose. The "deep flaw" in my argument consists simply in this, that my argument is confined to the subject in hand; and my reasoning is considered "absolutely without foundation" because, when I propose to prove *one thing*, I do not, at the same time, prove *another*. Yours faithfully,

St. Patrick's College, Maynooth, Jan. 21. Gerald Molloy.[1]

Amphisaurus amblyodus.—*From* Mr. T. P. Barkas, F.G.S.

Sir,—Among the recent fossil remains obtained from the Northumberland Low Main coal-shale is a jaw which I have reason to believe has not yet been named or described, and which certainly has not yet been recorded as present in these northern coal-fields.

My first introduction to the new reptile was through the kindness of Mr. Ward, of Longton, Staffordshire, in whose cabinet I saw, for the first time, a large portion of a jaw with very peculiar teeth. The length of the jaw was 4 in., and the teeth, which were eight in number, were placed at irregular intervals.

Within the last few weeks I have obtained a similar jaw from the Northumberland coal-measures; it is in two portions, one being 3 in. long, and the other, 1 in. In these fragments there are eight teeth, and the impression of one tooth. Each tooth is $\frac{9}{16}$ in. long, they rise almost perpendicularly from the jaw, and are of nearly uniform diameter to within $\frac{3}{16}$ in. from the apices: at that distance from the summit they turn off at an obtuse angle, and the apices of the teeth are very obtuse. A tolerably accurate representation of the form of the tooth may be obtained by placing the forefinger erect, and bending it at the upper joint. *Megalosaurus Bucklandii*, plate 62a, fig. 6a, Owen's *Odontography*, somewhat resembles the tooth, but, unlike the tooth of Megalosaurus, which is flattened and denticulated, the teeth of the new reptile are perfectly circular and free from denticulations. The depth of the jaw is $\frac{1}{2}$ in., the thickness at the anterior extremity is $\frac{1}{4}$ in., and towards the posterior extremity, $\frac{5}{16}$ in. The teeth are arranged at irregular intervals, occasionally the space between them is $\frac{3}{8}$ in., and, in other cases, the teeth are nearly in contact. Each tooth is marked by distant longitudinal striæ, and they are strongly plicated near the base.

The specimen in the possession of Mr. Ward and that in my possession are both mandibles, and having reason for believing that nothing more is known of the reptile, I propose provisionally to name it *Amphisaurus amblyodus*, the generic name signifying that it is a saurian of doubtful affinities, and the specific name that the teeth are not only obtusely pointed, but that they are also bent near the summits at an obtuse angle.

On the slab associated with the jaw of *Amphisaurus amblyodus* there are a ridged bone which has the appearance of a fragment of a scapula, and a large nodule of coprolitic matter.

I am yours obediently,

Newcastle-on-Tyne, Jan. 18. T. P. Barkas, F.G.S.

Gigantic American Flowers.—Dr. B. Seemann writes as follows to the *Gardeners' Chronicle*:—Tropical America enjoys the pre-eminence of producing the largest floral development in a good many natural orders, there being the *Victoria regia* amongst Nymphæaceæ, the *Brugmansia candida* amongst Solanaceæ, the *Lasiandra macrantha* amongst Melastomaceæ, the *Sapranthus Nicaraguensis* amongst Anonaceæ, the *Godwinia gigas* amongst Aroideæ, &c. Until I discovered *Sapranthus Nicaraguensis*, tropical Africa was supposed to possess the largest Anonaceous flowers in existence (Monodora), and now I learn from your columns that Dr. Welwitsch has found in Africa an Aroid even larger than my *Godwinia gigas*. As I "out-monodored" him in the Anonaceæ, of course I must not grumble if he "out-godwinias" me in Aroideæ; but I still trust that when actual measurements are produced, America may yet come off victorious in the question. There is no reason to assume that the few specimens of Godwinia measured in Nicaragua were the largest ever produced in the country, and there is every reason to assume that if my specimens, after suffering somewhat in their passage to England, attained the past season dimensions equalling within a few inches those of the plants in Nicaragua, they may exceed them even if Mr. Bull really does begin to cultivate them.

[1] If Dr. Molloy will again read the review of his interesting book, he will see that we neither expressed nor implied any charge of dishonesty against him. We gave him credit for zeal untempered by wisdom. So far as his arguments extend, they are not novel. We shall be glad to see how he attempts a reconciliation of the views of prehistoric archæologists and his interpretation of the Biblical chronology.—[Reviewer of "Geology and Revelation."]

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

(*Meeting of the 13th inst. continued from page 74.*)

VII. *On the Occurrence of Enstatite in the Busti Aërolite.*—Besides the augite already described there occurs in this meteorite another silicate which constitutes its most important ingredient. The augite is chiefly found in the nodule with the calcium sulphide, and is found more sparsely in the remaining parts. Associated with it throughout, and otherwise forming the chief mass of the stone, is a mineral which, in microscopic sections, presents the appearance of a number of more or less fissured crystals of varying transparency, some clear, some nearly opaque, and usually presenting a not very unsymmetrical polygonal outline. Those crystals are imbedded in a magma of fine-grained silicate, itself often entangled in an irregular meshwork of opaque white mineral. Amongst these ingredients, when mechanically separated, what seems to be three different minerals can be distinguished. The rarest of them is transparent and colourless, and very irregular in the form of its fragments; a second is of a greyish-white colour, translucent, and offering an even less hopeful problem to the crystallographer than that presented by the first. The third is an opaque mineral with a distinct cleavage following the faces of a prism of about $\frac{88\ 25}{91\ 27}$, and with a second imperfect cleavage perpendicular to the former. From a few fragments of the two former kinds some measurements were obtained, which conduct to the conclusion that, like the last-mentioned silicate, these minerals are enstatite. The angles 1 0 0, 1 1 0 are 46° 25′, and 1 0 0, 1 0 1, 41° 34′.

Chemical analysis confirmed the identity of these three minerals by showing them to be enstatite under different aspects. When lime is absent it presents itself as a simply prismatic mineral, the dark grey tabular variety. When lime is present, though to an amount less than two per cent., the crystalline structure becomes more complex. The augite may perhaps be tesselated, as it were, in the enstatite, somewhat as this latter mineral has been shown to occur intercalated to a small amount in layers of augite. I did not succeed in establishing this point, however, by an examination of microscopic sections of this mineral.

The crystalline fragments frequently show, when examined by polarized light, a composite structure, the principal sections of the different parts of the mineral being disposed at every angle of mutual inclination. The analysis of these minerals yielded the following numbers:—

	Dark Grey Tabular Variety. Per-centages.	Oxygen ratios.	Transparent White Variety. Per-centages.	Oxygen ratios.
Silicic acid	57·597	30·718	58·437	31·166
Magnesia	40·64	16·238	38·942	15·564
Lime	—	—	1·677	0·479
Iron oxide	1·438	—	1·177	—
Potash	0·394	—	0·332	—
Soda	0·906	—	0·357	—
	100·975		100·922	

	Semi-transparent Grey Variety. Per-centages. I.	Oxygen ratios.	Per-centages. II.	Oxygen ratios.	Per-centages. III.	Oxygen ratios.
Silicic acid	57·037	30·419	57·961	30·912	57·754	30·802
Magnesia	40·574	16·117	39·026	15·598	38·397	15·247
Lime	2·294	0·655	1·524	0·435	2·376	0·678
Iron oxide	0·867	—	0·154	—	0·423	—
Potash	—	—	0·569	—	0·569	—
Soda	—	—	0·68	—	0·657	—
Lithia	—	—	—	—	0·016	—
	100·772		99·914		100·192	

As in the case of the augite, the soda is probably derived from the hydrogen chloride; the iron occurs partly as metal, minutely subdivided, partly as oxide combined with the magnesium silicate. In each case the bases slightly exceed the amount required by the formula of enstatite. On comparing these with known analyses, and those which I shall shortly submit to the society, it seems highly probable that, where the conditions under which a meteoric silicate has been formed were such that silicate acid was present in excess of that required by the formula of enstatite, this acid remains uncombined, in the form of crystallized silica with the specific gravity of a fused quartz, and that where magnesia and other bases are in excess, a basic silicate with the formula of olivin absorbs the supplementary portion of these bases. Calcium, when present, would convert into augite its equivalent ratio of what would otherwise constitute enstatite, and it is possible that this is true even when this element is distributed in small quantities throughout the mass.

No alumina, and consequently no feldspathic ingredient, has been detected in this meteorite.

VIII.—*Composition of the entire Meteorite.*—With the view of determining the different ingredients, minerals present in the Busti meteorite, fragments and dust from the neighbourhood of the nodule of sulphide and augite were analyzed. The mineral was treated with hydrogen chloride, carbon disulphide, and potash, which removed 16·873 per cent., leaving a residue of 83·127 per cent.; the composition of these two portions, soluble and insoluble, is given below:—

	Soluble Portion. Per-centages.	Oxygen ratios.	Insoluble Portion. Per-centages.	Oxygen ratios.
Calcium sulphate	0·442	—	—	—
Calcium sulphide	4·133	—	—	—
Iron oxide	0·194	—	0·891	—
Silicic acid	6·514	3·474	46·357	24·727
Lime	0 022	0·006	12·375	3·535
Magnesia	5·055	2·02	23·266	9·299
Potash	0·099	—	0·14	—
Soda	0·118	—	0·455	—
Lithia	—	—	0·019	—
	16·577		83·503	

The ratio of the silicic acid to the magnesia and lime in the latter analysis corresponds with the composition $(\frac{3}{4}\ Mg\ \frac{1}{4}\ Ca)\ O, SiO_2$. Regarding the calcium of the white and grey varieties of enstatite to be present as augite intercalated with the enstatite, we may assert that while all the silicates of this meteorite present the typical formula MO, SiO_2, three equivalents of the rock near the nodule may be treated as composed of two equivalents of augite and one of enstatite; in other parts of the stone the latter mineral predominates.

A formula for the augite with magnesium and calcium in equal proportions would no doubt more truly represent its composition; it is, however, as impossible to separate the enstatite intercalated with it as it is to remove this mineral when blended with the enstatite.

IX. *Solubility of the Minerals of the Busti Meteorite.*—As it appears of importance to determine the degree to which these meteoric minerals were soluble in acid, the augite and enstatite were submitted to this solvent action. Digested for several hours at 100° C. in hydrogen chloride diluted with half its volume of water, and subsequently in potash for some hours to remove the free silica, the augite and each of the three forms of enstatite proved to be acted upon, the results in all cases showing that the acid simply exercises a solvent action on the mineral, without separating it into two or more distinct silicates.

The subjoined table gives the results of the experiments. The degree in which the acid dissolved the mineral was due to the more or less complete trituration of the material before treatment. In one case, for which the transparent variety was selected, a repetition of the process three times gave results that left no doubt as to the nature of the action of the acid.

Of the greyish-white variety of enstatite, after treatment for 20 hours with acid and 12 hours with potash, 9·414 per cent. dissolved, an analysis of which is given in column I.

Of the grey tubular variety of enstatite, after treatment with acid for 16 hours, and with potash for a similar time, 7·779 per cent. dissolved, that gave on analysis numbers the approximate value of which is found in column II.

Of the white variety, after the first treatment for 20 hours with acid, and subsequently with potash, 12·68 per cent. dissolved, the composition of which is given in column III. By a second treatment of the residual enstatite from this experiment, after 2 hours' trituration with acid for 30 hours and potash for 12 hours, 67·84 per cent. dissolved; and on subjecting the mineral to a third treatment in a similar way, 51·18 per cent. were dissolved in acid and potash. In the last of these experiments the ratio of the silica to the bases, neglecting the small amount of the former dissolved in the acid is as 58·4 to 42·0, that of an analysis of an enstatite being as 58·4 to 41·6.

The solubility of the augite was determined by subjecting it to similar treatment with acid during 18 hours, and with potash for a like time, these reagents removing 7·384 per cent. of the mineral.

	I.	II.	III.
Silicic acid	5·408	5·141	6·724
Magnesia	2·367	1·353	4·61
Lime	1·048	0·27	0·432
Iron oxide, &c.	0·187	0·676	0·576
Potash	0·121	0·528	0·504
Lithia	—	trace	trace
	9·131	7·968	12·846
Soda found	[0·126]	[1·217]	[1·042]

X. *The Iron of the Busti Meteorite.*—A small pepita of the iron, contained in the meteorite was analyzed. Omitting the silicate attached to the iron, the results of the analysis were as follows:—

Iron-nickel alloy		98·798
Iron	94·949	
Nickel	3·849	
Schreibersite		1·202
Iron	0·884	
Nickel	0·234	
Phosphorus	0·084	
	100·000	

The quantity was far too small to encourage a search for cobalt and other metals.

Besides the nickeliferous iron, which is disseminated very sparsely, and in particles singularly unequal in size and distribution, and with which troilite is associated in very small quantity, chromite is present as a constituent of small but appreciable amount. The crystals of this mineral are distinct and brilliant, and sometimes present good angles for measurement. One gave the solid angle of a regular octahedron.

The Manegaum Meteorite of 1843.—This meteorite fell at Manegaum, in Khandeish, India, on the 26th July, 1843. Only a small fragment was preserved, and of this a portion was given by the Asiatic Society of Bengal to the British Museum in 1862. In 1863 I described its appearance as seen in section in the microscope, and gave the particulars of its fall (*Phil. Mag.*, s. iv. p. 135, 1863).

From the minuteness of the specimen I had very little material to work upon. One mineral is conspicuous in the stone, namely, a primrose-coloured transparent crystalline silicate in small grains, loosely cemented by a white flocculent mineral. This greenish-yellow mineral (I.) and a fragment of the entire meteorite (II.) were analyzed, and crystalline grains of the former were measured on the goniometer. The prism angles (1) for the prism $\{1\,1\,0\}$ were about $\frac{88°}{92°}$, and (2) for the prism $\{1\,0\,1\}$ were $\frac{81°\,52'}{98°\,8'}$; for $\{1\,0\,0,\ 1\,1\,0\}$ about 46°; for $\{1\,0\,0,\ 1\,0\,1\}$, 49° 4′; and for $\{1\,1\,0,\ 1\,0\,1\}$, 58° 39′.

The analyses gave the following numbers:—

	I.	Oxygen ratios.	II.	Oxygen ratios.
Silicic acid ...	55·699	29·706	53·629	28·602
Magnesia ...	22·799		23·32	
Iron oxide ...	20·541	14·059	20·476	14·305
Lime	1·316		1·495	
Chromite.....	—		1·029	
	100·355		99·949	

The specific gravity of the granular mineral is 3·198, and its hardness 5·5.

The result of the above analyses is to show that, except for a little chromite and a little augite, with possibly in the crystallized mineral a little free silica, both that mineral and the collective silicate of the stone consist of a ferriferous enstatite.

The formula most in accordance with the analysis would be

$$(\tfrac{3}{4}\ \mathrm{Mg}\ \tfrac{1}{4}\ \mathrm{Fe})\ \mathrm{O},\ \mathrm{SiO_2};$$

that of the enstatite in the Breitenbach meteorite is

$$(\tfrac{3}{4}\ \mathrm{Mg}\ \tfrac{1}{4}\ \mathrm{Fe})\ \mathrm{O},\ \mathrm{SiO_2}.$$

The bulk of the Busti meteorite consists of a purely magnesian enstatite; this of Manegaum is almost entirely an enstatite richer in iron than any yet examined. Both bear evidence to the white flocculent mineral which characterizes the microscopic sections of many meteorites, being composed of this now important mineral enstatite.

In publishing the results I have obtained in the attempt, so far as this memoir goes, to treat exhaustively of the mineralogy of two important meteorites, I wish to record the obligations I am under to Dr. Flight, Assistant in my Department at the British Museum, for his valuable aid in the chemical portion of the inquiry.

"On Fluoride of Silver. Part I.," by George Gore, F.R.S.—This communication treats of the formation, preparation, analysis, composition, common physical properties, and chemical behaviour of fluoride of silver.

The salt was prepared by treating pure silver carbonate with an excess of pure aqueous hydrofluoric acid in a platinum dish, and evaporating to dryness, with certain precautions. The salt thus obtained invariably contains a small amount of free metallic silver, and generally also traces of water and of hydrofluoric acid, unless special precautions mentioned are observed. It was analyzed by various methods: the best method of determining the amount of fluorine in it consisted in evaporating to dryness a mixture of a known weight of the salt dissolved in water, with a slight excess of pure and perfectly caustic lime in a platinum bottle, and gently igniting the residue at an incipient red heat until it ceased to lose weight. By taking proper care, the results obtained are accurate. The reaction in this method of analysis takes place according to the following equation, $2AgF + CaO = CaF_2 + 2Ag + O$. Sixteen parts of oxygen expelled equal thirty-eight parts of fluorine present. One of the methods employed for determining the amount of silver consisted in passing dry ammonia over the salt in a platinum boat and tube at a low red heat. The results obtained in the various analyses establish the fact that pure fluoride of silver consists of nineteen parts of fluorine and 108 of silver.

"Approximate Determinations of the Heating Powers of Arcturus and *α* Lyræ," by E. T. Stone.—About twelve months ago, said the author, I began to make observations upon the heating-power of the stars. My first arrangements were simply these: I made use of a delicate reflecting astatic galvanometer, and a thermo-electric pile of nine elements. The pile was screwed into the tube of a negative eye-piece of the Greenwich Great Equatorial, from which the eye-lenses had been removed.

I soon convinced myself that the heat, condensed by the object-glass of 12¾ in. upon my pile, was appreciable in the case of several of the brighter stars; but the endless changes in the zero-point of the galvanometer-needle, and the magnitude of these changes, compared with those arising from the heating-power of the stars, prevented me from making any attempts to estimate the absolute magnitude of the effects produced. Every change in the state of the sky, every formation or dissipation of cloud, completely drove the needle to the stops.

At the February meeting of the Royal Astronomical Society I first became aware of what Mr. Huggins had done upon this question. His arrangements, however, did not appear to me to meet the difficulties which I had encountered. After some trials, I arranged my apparatus as follows, and with its present form I am satisfied.

I took two pairs of plates of compounds of antimony and bismuth. The areas are about $(0.075)^2$ in., and their distance is about 0·25 in.

The poles are joined over in opposite directions to the terminals of the pile and galvanometer. The whole pile is screwed into a tube of one of the negative eyepieces of the great equatorial. This completely shuts the pile up in the telescope-tube. A thick flannel bag is then wrapped over the eyepiece and terminals. The bag is prevented from actually touching the case of the pile, and is useful in preventing the irregular action of draughts upon the case of the pile and terminals. The wires are led from the terminals of the pile to the observatory library, where I have placed the reflecting galvanometer. This separation of the galvanometer from the telescope is most inconvenient, but it was absolutely necessary on account of the large moving masses of iron in the observing-room.

The two faces of the pile are so nearly alike, that the currents which are generated by an equal heating of them are exceedingly feeble.

The telescope is first directed so that the star falls between the faces, and allowed to remain thus until the needle is nearly steady at the zero.

The star is then placed alternately upon the two faces, and the corresponding readings of the galvanometer taken as soon as the needle appears to have taken up its position, which usually takes place in about ten minutes. In order to avoid changes of zero, I have always reduced those readings by comparing a reading with star on the one face with the mean of two readings with star on the other, taken before and after the reading with star on the first, or *vice versâ*.

With this precaution I have never met with any anomalous results, although in making the observations I have usually joined over the terminals, without knowing the direction for heat, and have left this undetermined until the completion of the observations. I mention this because the differences in the readings for star on the one, which I call *α*, and star on the other, which I call *β*, in the state in which I use my galvanometer are small.

On many nights, when very slight appearances of cloud prevailed, I have not been able to make any satisfactory observations at all.

The number of divisions over which the spot of light travels on the galvanometer-scale for a given difference of temperature of the faces *α* and *β* is of course dependent upon many circumstances, and especially upon the position of the sensitiveness-regulation magnet of the galvanometer.

I have thought it useless, therefore, to publish any results unless obtained upon nights when the state of the galvanometer was eliminated by referring to an independent source of heat. The way in which this has been attempted is as follows:—

After obtaining the differences in the position of the spot of light on the galvanometer-scale for star on *α* and star on *β*, I remove the pile from the telescope, leaving all its galvanic connections untouched, and mount the pile so that the two halves of the face of a Leslie's cube, containing boiling water, each radiates heat upon one face *α* or *β* of the pile, placed at a known distance of about twenty inches from the cube. After some time the deflection of the needle will fall nearly to zero, and become steady enough for observation. A piece of glass is then placed to intercept from *β* a portion of the heat from one half of the face of the cube, and when the needle has taken up its position, the reading is taken. Next, the glass is placed to intercept a portion of the heat from the face *α*, and the galvanometer-reading

taken, as before, as soon as the needle has announced its position of rest.

Thursday, January 20th.—Dr. W. A. Miller, V.P., in the chair. The following paper was read:—"Preliminary Paper on Certain Drifting Motions of the Stars," by Richard A. Proctor, B.A., F.R.A.S.; communicated by Warren De La Rue, V.P.R.S.

A careful examination of the proper motions of all the fixed stars in the catalogues published by Messrs. Main and Stone (*Memoirs of the Royal Astronomical Society*, vols. xxviii. and xxxiii.) has led me to a somewhat interesting result. I find that in parts of the heavens the stars exhibit a well-marked tendency to drift in a definite direction. In the catalogues of proper motions, owing to the way in which the stars are arranged, this tendency is masked; but when the proper motions are indicated in maps, by affixing to each star a small arrow whose length and direction indicate the magnitude and direction of the star's proper motion, the star-drift (as the phenomenon may be termed) becomes very evident.

It is worthy of notice that Mädler, having been led by certain considerations to examine the neighbourhood of the Pleiades for traces of a community of proper motion, founded on the drift he actually found in Taurus his well-known theory that Alcyone (the *lucida* of the Pleiades) is the common centre around which the sidereal system is moving. But in reality the community of motion in Taurus is only a single instance, and not the most striking that might be pointed out, of a characteristic which may be recognized in many regions of the heavens. In Gemini and Cancer there is a much more striking drift towards the south-east, the drift in Taurus being towards the south-west. In the constellation Leo there is also a well-marked drift, in this case towards Cancer.

These particular instances of star-drift are not the less remarkable, that they (the stars) are drifting almost exactly in the direction due to the proper motion which has been assigned to the sun; because the recent researches of the Astronomer Royal have abundantly proved that the apparent proper motions of the stars are not to be recognized as principally due to the sun's motion. Mr. Stone has shown even that we must assign to the stars a larger proper motion, on the average, than that which the sun possesses. Looking, therefore, on the stars as severally in motion, with velocities exceeding the sun's on the average, it cannot but be looked upon as highly significant that in any large region of the heavens there should be a community of motion such as I have described. We seem compelled to look upon the stars which exhibit such community of motion as forming a distinct system, the members of which are associated indeed with the galactic system, but are much more intimately related to each other.

In other parts of the heavens, however, there are instances of a star-drift opposed to the direction due to the solar motion. A remarkable instance may be recognized among the seven bright stars of Ursa Major. Of these, the stars β, γ, δ, ϵ, and ζ, are all drifting in the same direction, and almost exactly at the same rate, towards the "apex of the solar motion," that is, the point *from* which all the motions due to the sun's translation in space should be directed. If these five stars, indeed, form a system (and I can see no other reasonable explanation of so singular a community of motion), the mind is lost in contemplating the immensity of the periods which the revolutions of the components of the system must occupy. Mädler had already assigned to the revolution of Alcor around Mizar (ζ Ursæ) a period of more than 7,000 years. But if these stars, which appear so close to the naked eye, have a period of such length, what must be the cyclic periods of stars which cover a range of several degrees upon the heavens.

In like manner the stars α, β, and γ Arietis appear to form a single system, though the motion of α is not absolutely coincident either in magnitude or direction with that of β and γ, which are moving on absolutely parallel lines with equal velocity.

There are many other interesting cases of the same kind. I hope soon to be able to lay before the Society a pair of maps in which all the well-recognized proper motions in both hemispheres are exhibited on the stereographic projection. In the same maps also the effects due to the solar motion are exhibited by means of great circles through the apex of the solar motion, and small circles or parallels having that apex for a pole.

It appears to me that the star-drift I have described serves to explain several phenomena which had hitherto been thought very perplexing. In the first place, it accounts for the small effect which the correction due to the solar motion has been found to have in diminishing the sums of the squares of the stellar proper motions. Again, it explains the fact that many double stars which have a common proper motion, appear to have no motion of revolution around each other; for clearly two members of a drifting system might appear to form a close double, and yet be in reality far apart and travelling not around each other, but more closely around the centre of gravity of the much larger system they form part of.

I may add that, while mapping the proper motions of the stars, I have been led to notice that the rich cluster around χ Persei falls almost exactly on the intersection of the Milky Way with the great circle which may be termed the equator of the solar motion; that is, the great circle having the apex of the sun's motion as a pole. This circumstance points to that remarkable cluster, rather than to the Pleiades, as the centre of the sidereal system, if indeed that system have a centre cognizable by us. When we remember that for every fixed star in the Pleiades there are hundreds in the great cluster in Perseus, the latter will seem the worthier region to be the centre of motion. I should be disposed, however, to regard the cluster in Perseus as the centre of a portion of the sidereal system, rather than as the common centre of the Galaxy.

The peculiarities of the apparent proper motions of the stars seem to me to lend a new interest to the researches which Mr. Huggins is preparing to make into the stellar proper motions of recess or approach.

ROYAL INSTITUTION OF GREAT BRITAIN.

FRIDAY, JANUARY 21ST.—Sir Henry Holland, president, in the chair. A most interesting lecture on Haze and Dust was delivered by Professor Tyndall. The president of the Institution was supported by the Right Hon. W. E. Gladstone, Earl Granville, the Dean of Westminster, Sir Edwin Landseer, Professor Huxley, Dr. Bence Jones, Mr. Gassiot, Mr. Warren De La Rue, and many other distinguished persons. Lady Augusta Stanley and a large assembly of ladies also graced the theatre with their presence. The Professor said: Solar light in passing through a dark room reveals its track by illuminating the dust floating in the air. "The sun," says Daniel Culverwell, "discovers atomes, though they be invisible by candle-light, and makes them dance naked in his beams."

In my researches on the decomposition of vapours by light I was compelled to remove these "atomes" and this dust. It was essential that the space containing the vapours should embrace no visible thing; that no substance capable of scattering the light in the slightest sensible degree should, at the outset of an experiment, be found in the "experimental tube" traversed by the luminous beam.

For a long time I was troubled by the appearance there of floating dust, which, though invisible to diffuse daylight, was at once revealed by a powerfully condensed beam. Two tubes were placed in succession in the path of the dust: the one containing fragments of glass wetted with concentrated sulphuric acid; the other, fragments of marble wetted with a strong solution of caustic potash. To my astonishment it passed through both. The air of the Royal Institution sent through these tubes at a rate sufficiently slow to dry it, and to remove its carbonic acid, carried into the experimental tube a considerable amount of mechanically suspended matter, which was illuminated when the beam passed through the tube. The effect was substantially the same when the air was permitted to bubble through the liquid acid and through the solution of potash.

Thus, on the 5th of October, 1868, successive charges of air were admitted through the potash and sulphuric acid into the exhausted experimental tube. Prior to the admission of the air the tube was *optically empty*; it contained nothing competent to scatter the light. After the air had entered the tube, the conical track of the electric beam was in all cases clearly revealed. This, indeed, was a daily observation at the time to which I now refer.

I tried to intercept this floating matter in various ways; and on the day just mentioned, prior to sending the air through the drying apparatus, I carefully permitted it to pass over the tip of a spirit-lamp flame. The floating matter no longer appeared, having been burnt up by the flame. It was therefore *organic matter*. When the air was sent too rapidly through the flame, a fine blue cloud was found in the experimental tube. This was the *smoke* of the organic particles. I was by no means prepared for this result; for I had thought, with the rest of the world, that the dust of our air was, in great part, inorganic and non-combustible.

Mr. Valentin had the kindness to procure for me a small gas-furnace, containing a platinum tube, which could be heated to vivid redness. The tube also contained a roll of platinum gauze, which, while it permitted the air to pass through it, insured the practical contact of the dust with the incandescent metal. The air of the laboratory was permitted to enter the experimental tube, sometimes through the cold, and sometimes through the heated tube of platinum. The rapidity of admission was also varied. In the first column of the following table the quantity of air operated on is expressed by the number of inches which the mercury gauge of the air-pump sank when the air entered. In the second column the condition of the platinum tube is mentioned, and in the third the state of the air which entered the experimental tube:—

Quantity of Air.	State of Platinum Tube.	State of Experimental Tube.
15 inches	Cold.....	Full of particles.
15 ,, ...	Red-hot	Optically empty.
15 ,, ...	Cold.....	Full of particles.
15 ,, ...	Red-hot	Optically empty.
15 ,, ...	Cold.....	Full of particles.
15 ,, ...	Red-hot	Optically empty.

The phrase "optically empty" shows that when the conditions of perfect combustion were present, the floating matter totally disappeared. It was wholly burnt up, leaving not a trace of residue. From spectrum analysis, however, we know that soda floats in the air; these organic dust particles are, I believe, the rafts that support it, and when they are removed it sinks and vanishes.

When the passage of the air was so rapid as to render imperfect the combustion of the floating matter, instead of optical emptiness a fine blue cloud made its appearance in the experimental tube. The following series of results illustrate this point:—

Quantity.	Platinum Tube.	Experimental Tube.
15 inches, slow.....	Cold.....	Full of particles.
15 ,, ,, ...	Red-hot	Optically empty.
15 ,, quick ...	,, ...	A blue cloud.
15 ,, ,, ...	Intensely hot.....	A fine blue cloud.

The optical character of these clouds was totally different from that of the dust which produced them. At right angles to the illuminating beam they discharged perfectly polarized light. The cloud could be utterly quenched by a transparent Nicol's prism, and the tube containing it reduced to optical emptiness.

The particles floating in the air of London being thus proved to be organic, I sought to burn them up at the focus of a concave reflector. One of the powerfully convergent mirrors employed in my experiments on combustion by dark rays was here made use of, but I failed in the attempt. Doubtless the floating particles are in part transparent to radiant heat, and are so far incombustible by such heat. Their rapid motion through the focus also aids their escape. They do not linger there sufficiently long to be consumed. A flame it was evident would burn them up, but I thought the presence of the flame would mask its own action among the particles.

In a cylindrical beam, which powerfully illuminated the dust of the laboratory, was placed an ignited spirit-lamp. Mingling with the flame, and round its rim, were seen wreaths of darkness resembling an intensely black smoke. On lowering the flame below the beam the same dark masses stormed upwards. They were at times blacker than the blackest smoke that I have ever seen issuing from the funnel of a steamer, and their resemblance to smoke was so perfect as to lead the most practised observer to conclude that the apparently pure flame of the alcohol lamp required but a beam of sufficient intensity to reveal its clouds of liberated carbon.

But is the blackness smoke? This question presented itself in a moment. A red-hot poker was placed underneath the beam, and from it the black wreaths also ascended. A large hydrogen flame was next employed, and it produced those whirling masses of darkness far more copiously than either the spirit-flame or poker. Smoke was therefore out of the question.

What then was the blackness? It was simply that of stellar space; that is to say, blackness resulting from the absence from the track of the beam of all matter competent to scatter its light. When the flame was placed below the beam the floating matter was destroyed *in situ*; and the air, freed from this matter, rose into the beam, jostled aside the illuminated particles, and substituted for their light the darkness due to its own perfect transparency. Nothing could more forcibly illustrate the invisibility of the agent which renders all things visible. The beam crossed, unseen, the black chasm formed by the transparent air, while at both sides of the gap the thick-strewn particles shone out like a luminous solid under the powerful illumination.

But here a difficulty meets us. It is not necessary to burn the particles to produce a stream of darkness. Without actual combustion, currents may be generated which shall exclude the floating matter, and therefore appear dark amid the surrounding brightness. I noticed this effect first on placing a red-hot copper ball below the beam, and permitting it to remain there until its temperature had fallen below that of boiling water. The dark currents, though much enfeebled, were still produced. They may also be produced by a flask filled with hot water.

To study this effect, a platinum wire was stretched across the beam, the two ends of the wire being connected with the two poles of a voltaic battery. To regulate the strength of the current a rheostat was placed in the circuit. Beginning with a feeble current the temperature of the wire was gradually augmented, but before it reached the heat of ignition, a flat stream of air rose from it, which when looked at edgeways appeared darker and sharper than one of the blackest lines of Fraunhofer in the solar spectrum. Right and left of this dark vertical band the floating matter rose upwards, bounding definitely the non-luminous stream of air. What is the explanation? Simply this. The hot wire rarefied the air in contact with it, but it did not equally lighten the floating matter. The convection current of pure air therefore passed upwards *among the particles*, dragging them after it right and left, but forming between them an impassable black partition. In this way we render an account of the dark currents produced by bodies at a temperature below that of combustion.

Oxygen, hydrogen, nitrogen, carbonic acid, so prepared as to exclude all floating particles, produce the darkness when poured or blown into the beam. Coal-gas does the same. An ordinary glass shade placed in the air with its mouth downwards permits the track of the beam to be seen crossing it. Let coal-gas or hydrogen enter the shade by a tube reaching to its top, the gas gradually fills the shade from the top downwards. As soon as it occupies the space crossed by the beam, the luminous track is instantly abolished. Lifting the shade so as to bring the common boundary of gas and air above the beam, the track flashes forth. After the shade is full, if it be inverted, the gas passes upwards like a black smoke among the illuminated particles.

The air of our London rooms is loaded with this organic dust, nor is the country air free from its pollution. However ordinary daylight may permit it to disguise itself, a sufficiently powerful beam causes the air in which the dust is suspended to appear as a semi-solid rather than as a gas. Nobody could, in the first instance, without repugnance place the mouth at the illuminated focus of the electric beam and inhale the dirt revealed there. Nor is the disgust abolished by the reflection that, although we do not see the nastiness, we are churning it in our lungs every hour and minute of our lives. There is no respite to this contact with dirt; and the wonder is, not that we should from time to time suffer from its presence, but that so small a portion of it would appear to be deadly to man.

And what is this portion? It was some time ago the current belief that epidemic diseases generally were propagated by a kind of malaria, which consisted of organic matter in a state of *motor-decay*; that when such matter was taken into the body through the lungs or skin, it had the power of spreading there the destroying process which had attacked itself. Such a spreading power was visibly exerted in the case of yeast. A little leaven was seen to leaven the whole lump, a mere speck of matter in this supposed state of decomposition being apparently competent to propagate indefinitely its own decay. Why should not a bit of rotten malaria work in a similar manner within the human frame? In 1836 a very wonderful reply was given to this question. In that year Cagniard de la Tour discovered the *yeast plant*, a living organism, which, when placed in a proper medium, feeds, grows, and reproduces itself, and in this way carries on the process which we name fermentation. Fermentation was thus proved to be a product of life instead of a process of decay.

Schwann, of Berlin, discovered the yeast plant independently; and in February, 1837, he also announced the important result, that when a decoction of meat is effectually screened from ordinary air, and supplied solely with air which has been raised to a high temperature, putrefaction never sets in. Putrefaction, therefore, he affirmed to be caused by something derived from the air, which something could be destroyed by a sufficiently high temperature. The experiments of Schwann were repeated and confirmed by Helmholtz and Ure. But as regards fermentation, the minds of chemists, influenced probably by the great authority of Gay-Lussac, who ascribed putrefaction to the action of oxygen, fell back upon the old notion of matter in a state of decay. It was not the living yeast plant, but the dead or dying parts of it, which, assailed by oxygen, produced the fermentation. This notion was finally exploded by Pasteur. He proved that the so-called "ferments" are not such; that the true ferments are organized beings which find in the reputed ferments their necessary food.

Side by side with these researches and discoveries, and fortified by them and others, has run the *germ theory* of epidemic disease. The notion was expressed by Kircher, and favoured by Linnæus, that epidemic diseases are due to germs which float in the atmosphere, enter the body, and produce disturbance by the development within the body of parasitic life. While it was still struggling against great odds, this theory found an expounder and a defender in the president of this Institution. At a time when most of his medical brethren considered it a wild dream, Sir Henry Holland contended that some form of the germ theory was probably true. The strength of this theory consists in the perfect parallelism of the phenomena of contagious disease with those of life. As a planted acorn gives birth to an oak competent to produce a whole crop of acorns, each gifted with the power of reproducing its parent tree; and as thus from a single seedling a whole forest may spring, so these epidemic diseases literally plant their seeds, grow, and shake abroad new germs, which, meeting in the human body their proper food and temperature, finally take possession of whole populations. Thus Asiatic cholera, beginning in a small way in the Delta of the Ganges, contrived in seventeen years to spread itself over nearly the whole habitable world. The development from an infinitesimal speck of the virus of smallpox of a crop of pustules, each charged with the original poison, is another illustration. The reappearance of the scourge, as in the case of the *Dreadnought* at Greenwich, reported on so ably by Dr. Budd and Mr. Busk, receives a satisfactory explanation from the theory which ascribes it to the lingering of germs about the infected place.

Surgeons have long known the danger of permitting air to enter an opened abscess. To prevent its entrance they employ a tube called a cannula, to which is attached a sharp steel point called a trocar. They puncture with the steel point, and by gentle pressure they force the pus through the cannula. It is necessary to be very careful in cleansing the instrument; and it is difficult to see how it can be

cleansed by ordinary methods in air loaded with organic impurities, as we have proved our air to be. The instrument ought, in fact, to be made as hot as its temper will bear. But this is not done, and hence, notwithstanding all the surgeon's care inflammation often sets in after the first operation, rendering necessary a second and a third. Rapid putrefaction is found to accompany this new inflammation. The pus, moreover, which was sweet at first, and showed no trace of animal life, is now fetid, and swarming with active little organisms called vibrios. Professor Lister, from whose recent lecture this fact is derived, contends, with every show of reason, that this rapid putrefaction and this astounding development of animal life are due to the entry of germs into the abscess during the first operation, and their subsequent nurture and development under favourable conditions of food and temperature. The celebrated physiologist and physicist, Helmholtz, is attacked annually by hay-fever. From the 20th of May to the end of June he suffers from a catarrh of the upper air-passages; and he has found during this period, and at no other, that his nasal secretions are peopled by these vibrios. They appear to nestle by preference in the cavities and recesses of the nose, for a strong sneeze is necessary to dislodge them.

These statements sound uncomfortable; but by disclosing our enemy they enable us to fight him. When he clearly eyes his quarry the eagle's strength is doubled, and his swoop his rendered sure. If the germ theory be proved true, it will give a definiteness to our efforts to stamp out disease which they could not previously possess. And it is only by definite effort under its guidance that its truth or falsehood can be established. It is difficult for an outsider like myself to read without sympathetic emotion such papers as those of Dr. Budd, of Bristol, on cholera, scarlet-fever, and small-pox. He is a man of strong imagination, and may occasionally take a flight beyond his facts; but without this dynamic heat of heart the stolid inertia of the free-born Briton cannot be overcome. And as long as the heat is employed to warm up the truth without singeing it over-much; as long as this enthusiasm can overmatch its mistakes by unequivocal examples of success, so long am I disposed to give it a fair field to work in, and to wish it God speed.

But let us return to our dust. It is needless to remark that it cannot be blown away by an ordinary bellows; or, more correctly, the place of the particles blown away is in this case supplied by others ejected from the bellows, so that the track of the beam remains unimpaired. But if the nozzle of a good bellows be filled with cotton wool not too tightly packed, the air urged through the wool is filtered of its floating matter, and it then forms a clean band of darkness in the illuminated dust. This was the filter used by Schroeder in his experiments on spontaneous generation, and turned subsequently to account in the excellent researches of Pasteur. Since 1868 I have constantly employed it myself.

But by far the most interesting and important illustration of this filtering process is furnished by the human breath. I fill my lungs with ordinary air and breathe through a glass tube across the electric beam. The condensation of the aqueous vapour of the breath is shown by the formation of a luminous white cloud of delicate texture. It is necessary to abolish this cloud, and this may be done by drying the breath previous to its entering into the beam; or, still more simply, by warming the glass tube. When this is done the luminous track of the beam is for a time uninterrupted. The breath impresses upon the floating matter a transverse motion, but the dust from the lungs makes good the particles displaced. But after some time an obscure disk appears upon the beam, the darkness of which increases, until finally, towards the end of the expiration, the beam is, as it were, pierced by an intensely black hole, in which no particles whatever can be discerned. The air, in fact, has so lodged its dirt within the lungs as to render the last portions of the expired breath absolutely free from suspended matter. This experiment may be repeated any number of times with the same result. It renders the distribution of the dirt within the lungs as manifest as if the chest were transparent.

I now empty my lungs as perfectly as possible, and placing a handful of cotton wool against my mouth and nostrils, inhale through it. There is no difficulty in thus filling the lungs with air. On expiring this air through the glass tube, its freedom from floating matter is at once manifest. From the very beginning of the act of expiration the beam is pierced by a black aperture. The first puff from the lungs abolishes the illuminated dust and puts a patch of darkness in its place; and the darkness continues throughout the entire course of the expiration. When the tube is placed below the beam and moved to and fro, the same smoke-like appearance as that obtained with a flame is observed. In short, the cotton wool, when used in sufficient quantity, completely intercepts the floating matter on its way to the lungs.

And here we have revealed to us the true philosophy of a practice followed by medical men, more from instinct than from actual knowledge. In a contagious atmosphere the physician places a handkerchief to his mouth and inhales through it. In doing so he unconsciously holds back the dirt and germs of the air. If the poison were a gas it would not be thus intercepted. On showing this experiment with the cotton wool to Dr. Bence Jones, he immediately repeated it with a silk handkerchief. The result was substantially the same, though, as might be expected, the wool is by far the surest filter. The application of these experiments is obvious. If a physician wishes to hold back from the lungs of his patient, or from his own, the germs by which contagious disease is said to be propagated, he will employ a cotton wool respirator. After the revelations of this evening such respirators must, I think, come into general use as a defence against contagion. In the crowded dwellings of the London poor, where the isolation of the sick is difficult, if not impossible, the noxious air around the patient may, by this simple means, be restored to practical purity. Thus filtered, attendants may breathe the air unharmed. In all probability the protection of the lungs will be the protection of the entire system. For it is exceedingly probable that the germs which lodge in the air-passages, and which, at their leisure, can work their way across the mucous membrane, are those which sow in the body epidemic disease. If this be so, then disease can certainly be warded off by filters of cotton wool. I should be most willing to test their efficacy in my own person. And time will decide whether in lung diseases also the woollen respirator cannot abate irritation, if not arrest decay. By its means, so far as the germs are concerned, the air of the highest Alps may be brought into the chamber of the invalid.

The lecture was illustrated by a series of chemical experiments, and there was great applause manifested during its delivery and at the close.

ZOOLOGICAL SOCIETY OF LONDON.

JANUARY 13TH.—John Gould, Esq., F.R.S., V.P., in the chair. The secretary called attention to certain additions to the society's menagerie during November and December last, amongst which was particularly noticed a rare American monkey (*Pithecia ouakari*) from the Rio Negro, deposited by L. Joel, Esq., C.M.Z.S.

A letter was read from Lord Lilford, F.Z.S., relating to the exact locality of a specimen of *Otus capensis*, lately living in the society's gardens.

A letter was read from Dr. A. Ernst, of Caracoas, C.M.Z.S., containing some notes on animals recently obtained in the vicinity of that city.

The Rev. H. B. Tristram, F.R.S., exhibited a pair of Tawny Eagles, (*Aquila nœvioides*) obtained near Etawah, N.W. India, by Mr. W. G. Brooks, C.E., being the first authentic examples of this species recognized from that country.

Mr. Swinhoe exhibited and made remarks on some skins of tigers and leopards from various parts of China.

Mr. Gould exhibited a new and very remarkable pigeon, supposed to be from New Guinea, which he had recently described under the name *Otidiphaps nobilis*.

A communication was read from Mr. Henry Adams containing descriptions of a new genus, and of eighteen new species of land and marine shells from the Red Sea, Hainan, and other localities.

A communication was read from Dr. Cobbold containing the description of a new generic type of Entozoa, discovered in a specimen of the Aard-Wolf (*Proteles cristatus*), which had recently died in the menagerie. To this were added remarks on the affinities of this Entozoon, especially in reference to the question of parthenogenesis.

A communication was read from Mr. Morton Allport, F.Z.S., containing a brief history of the introduction of the salmon (*Salmo salar*) and other Salmonidæ to the waters of Tasmania.

Dr. Murie read a paper containing additional memoranda on irregularity in the growth of salmon. Dr. Murie's observations were founded principally upon specimens hatched and reared in the society's fish-house.

ANTHROPOLOGICAL SOCIETY OF LONDON.

ANNUAL GENERAL MEETING, JAN. 18TH.—John Beddoe, Esq., M.D., president, in the chair. The report of auditors showed the income of the society in 1869 to have been £1,091. 9s. 5d., the expenditure £964. 9s. 8d., and the balance in hand on the 31st Dec., £126. 19s. 9d. The report of council was read and adopted. The president then delivered the annual address, including a full obituary notice of Dr. James Hunt, founder of the society. The ballot for the election of officers and council to serve in 1870 was taken with the following result:—President, John Beddoe, Esq., M.D.; Vice-presidents, H. Beigel, Esq., M.D., Captain R. F. Burton, Dr. Charnock, J. Barnard Davis, Esq., M.D., F.R.S., Captain Bedford Pim, R.N., Dr. Berthold Seemann; Director, Thos. Bendyshe, Esq., M.A.; Treasurer, Rev. Dunbar I. Heath, M.A., Council, J. Gould Avery, Esq., J. Burford Carlill, Esq., M.D., S. E. Collingwood, Esq., Walter C. Dendy, Esq.; George Harris, Esq., Jonathan Hutchinson, Esq., W. B. Kesteven, Esq.; Kelburne King, Esq., M.D., Richard King, Esq., M.D., A. L. Lewis, Esq., St. Geo. J. Mivart, Esq., F.R.S., Major

S. R. I. Owen, C. Robert Des Ruffières, Esq., John Thurnam, Esq., M.D., Edward Peacock, Esq., F.S.A., J. Spence Ramskill, Esq., M.D., W. S. W. Vanx, Esq., F.R.S., C. Staniland Wake, Esq., Alfred Wiltshire, Esq., M.D., and E. Villin, Esq.

MATHEMATICAL SOCIETY.

JANUARY 13TH.—Professor Cayley, president, in the chair. Dr. Ramsay was proposed for election. Mr. Walker gave an account of his paper "On Equations of Centres and Foci, and conditions of certain Involutions." Dr. Henrici, Professor Hirst, Mr. Clifford, and the president, took part in a discussion on the subject. The president then made a statement of some results he had arrived at with reference to Quartic surfaces. Mr. Roberts exhibited and explained some diagrams of the pedals of conic sections which he had constructed by the methods described in his communication of January 14th, 1869.

STATISTICAL SOCIETY.

THE third ordinary meeting of the present session was held on Tuesday last, the 18th of January, William Newmarch, Esq., F.R.S., president, in the chair. The following gentlemen were elected fellows:—Messrs. Iltudus Thomas Prichard, Henry Hoare, David Maclagan, and Josiah Samuel Parker. Professor Lee read a paper on "The Statistics of Joint-Stock Companies from 1814 to the present time, and of Companies with Limited and Unlimited Liability formed since the year 1856."

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this society on Tuesday, the 11th inst., Mr. Charles B. Vignoles, F.R.S., president, in the chair, five candidates were balloted for and declared to be duly elected,—viz., Mr. Alfred Andrew Langley, engineer and manager to the Hereford, Hay, and Brecon Railway; Mr. Robert White, first-class engineer upon the Great Southern of India Railway; and Mr. Edmund Wragge, chief engineer of the Toronto, Grey, and Bruce, and the Toronto and Nipissing Railways, in Canada, as members; and Mr. William Rawlinson, engineer and manager of the Brazilian Street Railway Company, and Mr. Charles Willman, Middlesbrough, as associates.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

ORDINARY MEETING, DEC. 28TH, 1869.—J. P. Joule, LL.D., F.R.S., &c., president, in the chair. "On Pollen; considered as an Aid in the Differentiation of Species," by Charles Bailey, Esq.—Having recently examined the pollen of several thousand species of plants, I am led to think that the characters presented by these grains might prove useful as a means of differentiation in allied species; my researches, however, have not been sufficiently extensive to form any positive conclusions, but as leisure permits I hope to prosecute the subject further. In the meanwhile the following notes are thrown out as indications of some of the more noticeable distinctions to be drawn from a careful comparison of these organs, and they may serve to draw the attention of others to the matter.

There are four points, in one or other of which pollen grains of plants belonging to the same genus may be found to differ from each other, viz., form, markings, dimensions, and colour.

1. *Form.*—It has long been noticed that certain types of pollen are characteristic of the natural order to which the plants which produce them belong, as, for instance, the peculiar pitted polyhedral pollen of the Caryophyllaceæ, the spherical spiny pollen of the Malvaceæ, the large triangular pollen of the Onagraceæ, the peculiar pollen of the Coniferæ, or the elliptical pollen of the Liliaceæ and other monocotyledonous orders; in fact, most orders possess a type sufficiently marked to be characteristic of each. This statement, however, must be accepted with limitations; the Compositæ, for instance, have three or more well-marked types, represented by the beautifully sculptured pollen of the Chicory, the minute oval spiny pollen of the Asters, Calendulas, Cacalias, &c., and another form wholly destitute of spines as in the *Centaurea Scabiosa*. There are, besides, other natural orders where similar variety occurs.

But differences of form are met with in plants of the same genus, by which the one species or the other is readily marked off by its pollen; thus the pollen grain of *Anemone sulphurea* is roundish, but that of *Anemone montana* is elliptic; the pollen of *Aronicum Doronicum* is much more elongate than that of *A. Scorpioides;* and while the grains of *Ranunculus philonotis* are round and yellow, those of *R. platanifolius* are elliptic, white and smaller.

2. *Markings.*—Here again there is endless diversity, and a boundless field lies open for the researches of tired-out dot-and-line hunters of diatom-valves. A few instances only of the more striking differences can be given here.

The pollen of the Geraniaceæ and Campanulaceæ is for the most part globular, but while some of the grains are quite smooth others are covered with spines; thus the pollen of *Campanula Media* has a number of short spines sparsely scattered over the surface of the grain, but *C. ranunculoides* is wholly destitute of them. In other plants these spines are replaced by tubercles, and both spines and tubercles vary greatly in length and number; for example, in *Valeriana tuberosa* the spines are only half the length of those on the pollen of *V. montana*, the grains being also slightly smaller. The pollen of the Liliaceæ is often covered with a more or less prominent reticulation, which is subject to much variation; compare, for example, the coarse network which invests the pollen of *Lilium croceum* with the finer reticulation of *L. canadense*, the grains of the latter species being much more globose and smaller.

3. *Dimensions.*—Some instances of the differences observable in the size of pollen grains have already been published by Professor Gulliver, whose measurements of the pollen of various species of Ranunculus show the help that may be derived from this character; *R. arvensis* is nearly twice the size of *R. hirsutus*, their dimensions being respectively $\frac{1}{170}$ and $\frac{1}{330}$ of an inch.

I have not had the time to make similar careful measurements with the micrometer, but I have seen sufficient to be satisfied that while there is considerable variation in dimensions between the pollen of one species and that of another, they are tolerably constant in size in the same species.

For some noticeable differences compare the smaller pollen of *Epilobium brachycarpum* with the larger pollen of *E. Fleischeri* or that of *Senecio gallicus* with *S. incanus*, the spines on the latter species being also much coarser. Again, the pollen of *Silene acaulis* is but half the size of that of *S. alpina*, the latter having some beautiful markings in addition; the pollen grains of this genus differ from the usual caryophyllaceous type in not having the pits or depressions common in the order, so that the grains become spherical rather than polyhedral.

4. *Colour.*—This is not so reliable a character for differentiation as the others noticed, since species differ amongst each other according to the soil, &c., of the place where they have grown. I remember gathering some years ago, near Ashbourne, Derbyshire, a variety of *Stellaria Holostea* having a dark purple pollen instead of the ordinary pale yellow. An example or two under this head will suffice.

The pollen of *Ajuga genevensis* is yellow, but that of *A. pyramidalis* is usually white; again, while the grains of *Ornithogalum umbellatum* are large and yellow, those of *O. nutans* are small and white.

Some objection may be raised to any reliance being placed upon the dry shrivelled-up grains of herbaria specimens—such specimens being in most cases the only ones obtainable for purposes of investigation; but the structure of pollen is such as to bring into greater prominence the pores, folds, valves, and other markings which are met with on their surface after the grains have collapsed by the discharge of their contents.

In regard to the mounting of these objects for the microscope, they show to the best advantage when put up perfectly dry; the cells should be sufficiently shallow to admit of no more than a single layer, and at the same time deep enough to permit the grains to move about. If pollen is mounted soon after it has been discharged from the fresh anthers the fovilla is apt to condense on the covering glass, and the slide soon becomes useless. The stamens taken from an unopened flower-bud furnish the best and cleanest pollen, and these should be selected in preference to those taken from the fully developed flower.

Canada balsam, glycerine, and other media are occasionally helpful in making out structure; thus the pores of *Campanula rotundifolia*, *Phyteuma halleri*, and other allied species are made much more distinct when mounted in balsam.

A large series of slides illustrative of the above remarks was exhibited at the meeting.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

December 6th, 1869.—John Watson, Esq., president of the section, in the chair. Mr. W. Boyd Dawkins, M.A., F.R.S., was elected a member of the section.

Mr. J. B. Dancer, F.R.A.S., read a short paper on some of the new hydrocarbon compounds from which he had obtained very beautiful polarizing objects for the microscope. These were exhibited to the members, and a more detailed account promised when the experiments are complete.

BRISTOL MICROSCOPICAL SOCIETY.

JANUARY 19TH.—Mr. W. J. Fedden, president, in the chair. The minutes of the last meeting having been read and confirmed, it was announced that Mr. Roper, honorary secretary, Royal Microscopical

Society of London, had presented to the society a copy of his book, *A Catalogue of Microscopical Works*. A unanimous vote of thanks was accorded to Mr. Roper for his donation, and he was proposed as an honorary member of the society, to be balloted for at the next meeting. Some discussion then ensued on the advisability of the society holding a public soirée. There was a considerable diversity of opinion, and the matter was finally referred to the standing committee. Mr. Tibbits then read a paper "On Mounting Animal Tissues," which he illustrated by a number of beautiful preparations of brain and spinal cord made by himself.

LEEDS PHILOSOPHICAL AND LITERARY SOCIETY.

At the last general meeting of this society, on Tuesday, January 18th, the curator, Mr. Denny, announced, amongst other valuable donations to the museum, as just received, a very fine and perfect male specimen of the Pichiago (*Chlamyphorus truncatus*), from the mining district of Mendora, Argentine Republic. The specimen has been pronounced by Dr. Burmeister, director of the museum in Buenos Ayres, as much superior to that in his possession.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

January 13th.—The president, Mr. T. H. Hennah, in the chair. Mr. J. E. Mayall communicated a note on what he believed to be a new fact in connection with coal-gas. While engaged in the spectrum analysis of organic bodies, he had found the presence of copper interfere with the results. Examining the solutions, no trace of copper could be found: it then occurred to him that it might be present in the common coal-gas used in the Bunsen lamp. Having candles with wicks dipped in the chlorides of several metals always handy, as standard spectra, he compared the flame of a copper candle with the flame of the coal-gas, and found their spectra identical. He inferred from this that the copper was generated from the pyrites contained in the coal.

Mr. Mayall then read a paper on "Volcanic Theories."—If science were nothing more than a registry of facts, it would still be a degradation to assign everything to a special cause, a plan pursued in the past, and which had led to extravagant theories. No branch of science could be taken alone, but in conjunction with other branches, thus the study of geology must be taken in connection with the astronomical motions of the earth; and all volcanic action was intimately connected with astronomy. Taking the ideas of Laplace respecting the extent of the solar atmosphere, and the manner in which nebulous matter condensing would break off into zones, which on cooling would assume the spheroidal form, and go on rotating, it was seen that the whole solar system rotated nearly in the same plane, and in the same direction as the sun. Not only was it evident from the examination of our earth that it had passed through periods of development, but spectrum analysis revealed the fact of its constituent elements being identical with those of the sun, while meteorites were proved to contain the same metals as those found in our earth. The rocks composing the earth's crust were clearly of both aqueous and volcanic origin. Though volcanic action was feeble in the present compared with the past, still a great submarine action was going on and raising the bed of the Pacific Ocean. Many parts of the earth, in which no active volcanoes were at present seen, showed, from the nature of their mountains, that they had been centres of volcanic action. Looking at the active volcanoes, it would be seen that there were 22 series of volcanic mountains near the sea, and nearly parallel to the coast-line. The geographical position, heights, and dates of eruption of 400 known active volcanoes had been tabulated, these varied in height from 939 ft. to 23,000 ft. above the sea-level, and acted as safety-vents to the volcanic matter pent up within the earth. It had been noticed that earthquakes preceded or followed volcanic eruption; this was well seen in the great earthquake of Lisbon, which shook $\frac{1}{12}$th part of the earth's surface; and in the eruptions of Vesuvius, in 1767, so well described by Sir W. Hamilton.

The interior of the globe was filled with a fluid molten mass, portions of which separating caused local action; when any portion came in contact with water, it swelled out, producing upheavals, depressions, fractures, &c. Tracing the lines of volcanic distribution, they would be seen to be in parallel lines, having a spiral tendency, and corresponding to the corkscrew motion of the earth. The great mass of volcanic action lay between the tropics; if beyond the tropics, they were deeply connected with the molten matter. Looking at the comparative density of the earth, it was evident that the mass augments in density towards the centre, in addition to the tendency of compression to produce a similar result. Not only on the earth, but in the moon, evidences of volcanic action were apparent, and almost nightly Mr. Pratt, of Brighton, was adding some new fact in connection with the volcano Plato. Turning to the sun, the solar spots and other phenomena tended to show that volcanic action was going on there. Pointing out the various steps which had led to spectrum analysis, the sun was shown to be in a state of perpetual incandescence. Though there were 400 active volcanoes, no sufficiently systematic observations on them had been made; one thing was evident, that the deeper-seated ones, being more closely connected with the central mass, would produce the heavier metals. The pericyclosital or corkscrew motion of the earth, produced by the nutation of the axis and the precession of the equinoxes, depressed the poles, and shifted the equatorial points, therefore altering the earth's surface in relation to the sun. This slow motion explained how in Iceland there had been a flora and fauna similar to that of temperate England. Seeing that the equatorial diameter was some 25 miles greater than the polar, it was clear the crust would be thinner, and therefore volcanic action would be greater and more frequent within the torrid zones. Again, all the volcanic chains agreed with the curve formed by the earth's pericyclosital motion. He believed in a slow and progressive development, and in an intimate connection between cosmical, astronomical, and volcanic action.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

The meetings were resumed on the 11th instant, when Mr. S. Allport exhibited and described a fine collection of Foraminifera from the West Indian and Mediterranean Seas, obtained by shaking sponges brought from those regions over water, skimming off the shells which float while the particles of sand sink to the bottom, and mounting the specimens thus obtained in Canada balsam, after preliminary treatment with turpentine and exhaustion of air from the chambers. Special interest attaches to these organisms at the present time by reason of the attention which has lately been directed to them, in connection with the subject of deep-sea soundings, as the great chalk-forming agents of the world. Mr. Allport further referred to certain passages in systematic works on Foraminifera, with a view to prove that in this as in other branches of natural history, varieties are too often unjustifiably elevated to the rank of species. The specimens exhibited in illustration of the subject included representatives of the genera Peneroplis, Spirolina, Orbiculina, Orbitolites, Polystomella, and Planorbulina. The Rev. H. W. Crosskey also contributed *Globigerina bulloides* from 2,000-fathom soundings in the Atlantic; and foraminifera from chalk; and in connection with these made some interesting remarks on points of geology suggested by Dr. Carpenter's recent lectures. The speaker observed that modern geologists would find themselves compelled to depart from the strict and arbitrary rules by which they had hitherto separated different epochs and formations, the tendency of progressive discovery being to show that these extend into or overlap each other so that no harsh line of demarcation can be drawn. He also alluded to the difficulty with which geologists have hitherto had to contend in explaining the great break in the system between the cretaceous and tertiary periods, which recent discovery has in a great measure enabled us to do. Among general specimens exhibited were the shells *Bythinia tentaculata* type, var. *ventricosa*, brown and white; and var. *albida*, all from Alum Rock, the last being a new variety, found by Mr. Lloyd, and named last month by Mr. Jeffries; also, *Sphærium corneum*, var. *flavescens*, from Plant's Brook, all contributed by Mr. R. M. Lloyd; and a collection of cones and olives, forming the second part of a series of foreign shells, presented to the society by Mr. Keen, of Liverpool.

At a subsequent meeting, Mr. S. Allport also contributed the first instalment of a series of minerals, forming the constituents of igneous and metamorphic rocks; 1st, the group of Felspars, including specimens of Orthoclase, Albite, Oligoclase, and Labradorite, with the varieties Adularia and Sanadine; 2nd, Pyroxenic minerals, comprising Augite, Hornblende, Bronzite, Dillage, Hypersthene, Actinolite, Tremolite, with specimens of Mica, Quartz, Leucite, and Nephelite; also some of the Zeolites most frequently found in cavities of the older igneous rocks, and the minerals Tourmaline, Epidote, Garnet, Idocrase, Chlorite, and Spodumene.

Mr. J. Bagnall exhibited *Tortula papillosa*, and several other mosses, not previously recorded as occurring in the district, and on behalf of Dr. Braithwaite, *Andræa rupestris* and *A. obovata*, two recent additions to the British Flora, from Glen Callater; Mr. E. Myers contributed fragments of boulders and wood from Boulder Clay at Sefton Park, near Liverpool, and described the drift section in which they were exposed; and Mr. E. Simpson laid on the table thirty species of Marine Mollusca taken on the coast of Jersey.

PHILOSOPHICAL INSTITUTE OF CANTERBURY NEW ZEALAND.

The annual dinner of the Philosophical Institution took place on the evening of Oct. 8th, 1869, at Mr. Morton's commercial rooms.

Dr. Haast, the president of the Institute, occupied the chair, and was supported on his right by his honour the superintendent, and on his left by his honour Mr. Justice Gregson.

After the cloth had been removed, Dr. Haast delivered the annual address (which we give below); and the usual loyal and patriotic toasts were then duly proposed and responded to, the Rev. C. Fraser proposed the memory of Captain Cook in an able speech, the report of which we are compelled to hold over. After spending a pleasant evening, the company broke up about eleven o'clock.

President's Address.

Your Honour and Gentlemen,—When, seven years ago, I had the honour, as first president of this Institution, to address you at your first anniversary dinner, I offered you a short *résumé* of the scientific researches and results obtained in New Zealand since the time when the colony was formed. An attempt to do so to-day for the past seven years would be a far greater, but also still more gratifying, task, owing to the wonderful advancement New Zealand has made during that time in intellectual pursuits, and their results—a matter of great and sincere congratulation to the members of this society, and to the colony at large. When, in 1862, the Philosophical Institute of Canterbury was called into existence, there was no other society in New Zealand which had the ambition to aspire to such high aims as we did, and although we failed in many respects to carry out our programme, we may, at least, safely claim the merit of having formed a depository for scientific researches in Canterbury, which did not at that time exist in any other part of New Zealand. It is true there was an older society, with similar aims to ours, in Wellington; but for many years the members had not met, and, in consequence, some of them had their papers read before you. But how different is it to-day? Not only have scientific societies been created throughout the colony, but they have likewise found a centre in the New Zealand Institute in Wellington, the well-directed efforts of which will result in great advantages, both in an intellectual and material point of view, to the inhabitants of the land of our adoption.

The first volume of the *Transactions and Proceedings of the New Zealand Institute*, embodying the labours of all the affiliated societies, which is in our hands, gives palpable proof both of the value of that body, even in the first year of its existence, and of the marked attention which has been paid to scientific matters, even amidst the absorbing occupations incidental to founding a colony. And from year to year the value of the institute will be enhanced by its evoking in many quarters scientific research, often of great utility in promoting the advancement of the colony, which otherwise would have lain dormant, either from the want of example and encouragement, or of a proper organ for publication. Whatever may be the political tenets of those who are friends of science, literature, and art in New Zealand, in one thing I am sure they will agree with me—that in any circumstances a centre for the maintenance of intellectual life amongst the inhabitants of New Zealand is of incalculable importance to us all, and that the creation of a depository where the results, whether small or great, of all labourers in the domain of the mind, can be collected and published, is an important step towards the advancement of this colony to that position which it deserves to occupy. These labours, after becoming at once accessible to the present inhabitants, will be preserved for coming generations, forming, as it were, the foundation-stone of future research.

Viewed, however, from another point of view, the encouragement of intellectual, and in this instance I may say, physical research, will be of the highest benefit to the colony, as it will most probably lead us to pay more attention to the study of physical science in our schools, high and low, than has hitherto been the case. Unless this be done, our colonial youths, when they come into competition with new arrivals from the Northern hemisphere, will have no chance in the struggle of life. I think the time is long since past when the education of a young man who does not intend to follow any of the so-called learned professions, should be considered finished when he has acquired some knowledge of Latin, a little less of Greek, with the rudiments of Mathematics, all of which, as soon as he enters active life, he usually tries to forget as fast as possible, owing to his having, as a general rule, by always being over-worked, been bored to death by them. But the things he ought to have learnt, which he would treasure in his mind, which would give him intellectual enjoyment and invest him with great advantages, both intellectual and practical over those who had not followed the same course of study, he has never been taught, and any allusions made to them have often been of a disparaging character. The universe, the sublime law by which the innumerable suns, planets, and their satellites around him are governed; the earth, which is his home, with all its wonderful treasures, animate and inanimate, and their relations to each other are totally unknown to him. He wanders as it were blindfolded over this beautiful earth—a stranger in his own domain—heaven and earth a sealed book to him. And is it possible that any other study, however sublime, can be compared with that of the works of God, which certainly must elevate the mind far higher than that of the works of men, however excellent they may be? But in order that I may not be misunderstood, I wish to assure you that I should be very sorry indeed to see classical languages and mathematics removed from the curriculum of our schools. Such a proceeding would also be suicidal to the aims of physical science. The study of any language, whether ancient or modern, and of its best authors, will always enlarge and elevate the mind, exercise the memory, and evoke or cherish noble feelings and actions in the learner, whilst the study of mathematics will teach him to think logically and accurately, without which physical science would be above his comprehension. The acquisitions of the natural philosopher, of the astronomer, of the chemist, or of the geologist, obtained by actual research or by induction, can only be considered of lasting value if they have been corroborated or proved by strictly mathematical reasoning, in having, as it were, been reduced to mathematical formulæ. But, here again, I may once more point out that only those young men will reap the full benefit of the wisdom of the ancients and of mathematical investigations who intend to continue their philological and mathematical studies, while those who, after leaving school, enter into a walk of life in which such knowledge is not required, will shortly have forgotten all that was drummed into them during a number of years, and, at the same time, will have cause to regret at every step they take, both their ignorance of physical science and their want of acquaintance with the laws and treasures of nature around them.

The question naturally arises why, since physical science has made such wonderful strides during the last three centuries, that mankind has advanced more during that time than in any similar period before in the history of the world, the education of youth, even of the higher classes, has been almost stationary; so that we can only say it still resembles in many respects the course of teaching in those times when the native language of the country was despised as unworthy of being taught; when old women were burnt as witches; when the stars in the firmament were only thought to be placed in the heavens to form constellations by which the life or fate of man was guided; when chemistry was alchemy, and its chief use considered to be the making of gold from baser metals, or the brewing of the elixir of life; and when the little knowledge of physical science (natural history included) possessed in those days was mixed up with superstition and scholastic axioms? The answer to this question seems to me to be very simple. The only exact knowledge possessed at that time was mathematics, principally the higher branches, together with the philosophical, political, and prose writings of the eminent men who had shed a bright lustre over the periods in which they lived. These writings were the precious heirloom which antiquity had bequeathed to the middle ages. And such learning was then considered to be the only kind of knowledge worth possessing, all intellectual energy was directed to its acquisition, and the professors of the day despised the ignorance and superstition of those to whom the treasures of antiquity were not accessible. They also, and naturally, showed contempt for alchemists, astrologers, and others pursuing knowledge in a similar manner, and while unable to refute the latter, their mathematical knowledge made them feel that the doctrines of those men were erroneous. A remnant of this feeling of contempt for the study of physical science still lingers in some countries amongst the teachers of the so-called classical schools, although they do not like to confess it even to themselves; and being desirous of continuing the teaching of their predecessors, they consider it as the invasion of an upstart into the holy precincts of their educational temple when physical science wishes to enter the schoolroom. Unfortunately, many of these teachers, however eminent in other respects, know very little of physical science, and this may be an additional reason why they resist its introduction into the curriculum, since they are not able to understand its value; while it must be allowed that they have just cause to look with pride upon many distinguished men who, educated at their schools, have without such knowledge brought great credit to those institutions. Here human nature simply comes into play.

On the continent of Europe and the United States, this defect has already been partially remedied, and in Great Britain powerful advocates, even from the ranks of the most eminent classical scholars, have come forth to break their lances for the introduction of such studies into all schools. In your mother country they are mostly men who have travelled, who have seen the advantages conferred by such studies upon a whole generation in other countries. They have witnessed the delight of the pupils when, after the study of languages and mathematics, natural history, geology, mineralogy, and chemistry had their turn, and refreshed the scholars for the drier work. They have seen what a treasure the pupils carry with them when they leave school by possessing some knowledge of the laws by which the Universe, from our central sun down to the smallest atom upon the earth, is governed, and experiencing that delight which a contemplation of Nature affords—how it ennobles their daily occupation, fills their leisure hours, and teaches them to observe and think. But what intellectual resources of this kind has a young man who leaves a school conducted on the present system? Is he not nearly as much a stranger on this beautiful earth as when he first came upo it, and where will he find time, amid

the turmoil of life, to gain that knowledge so necessary to him nowadays, but which, during the many years of his school life, was withheld?

I trust you will not think I am overstepping my privileges in thus openly expressing my opinion about the present mode of teaching the rising generation, but I should neither be doing my duty, nor deserve the honourable position in which you have placed me, did I not state fearlessly and without restraint, my convictions on the subject. But, I repeat, that should not some attention be soon paid in our schools to the study of physical science, the time is not distant when in the race of life and in the competition with young men from other countries, our colonial youth will be left far behind. However, I have no doubt that many years will not elapse before the people of Great Britain, which of all nations has the most practical national sense, will thoroughly remedy the evil, and that there will be no country on the face of the earth where the study of physical science is more fostered, so as to preserve to that empire its pre-eminence in the great race of nations, in which, after all, the arts of peace, civilization, and industry will give the ultimate decision. I have detained you too long upon a subject which, during the last few years, has been treated by such able and distinguished men, that perhaps I could have left it in their hands had I not thought it my duty to allude to it.

In order to honour more fully the memory of that illustrious navigator who was the real discoverer of New Zealand, we have fixed the day of our anniversary dinner upon the day when, one hundred years ago, Captain Cook landed officially in New Zealand, and it is from that day that the blessings of civilization have been bestowed upon these beautiful islands. Captain Cook was forty-one years old when he reached our coasts, he being born on the 27th August, 1728. He was in every respect a son of the people, having raised himself from the ranks by his knowledge, honesty of purpose, and courage—one of the most remarkable men which the 18th century produced. He not only advanced far into the Arctic, but also explored three times the Antarctic Zone, which had never been visited before. It is from him that we not only obtain the earliest reliable accounts of most of the islands of the Pacific Ocean, of the north-west coast of America, of Behring's Straits, and of the Antarctic regions; but he also fixed astronomically innumerable points on the coasts visited by him, generally with such admirable accuracy that we still look upon them as reliable authorities. His accounts of the geographical features of the countries visited by him, and of the manners and customs of their inhabitants, are also among the most reliable and valuable we possess. He died in the cause of science—an irreparable loss not only to his country, but to the world at large. Truly he may claim to be called the Columbus of the Pacific Ocean, and the inhabitants of the Australian Colonies and New Zealand owe him a great debt of gratitude, because it was his foresight and his excellent judgment of the natural capabilities of the countries visited which principally directed the attention of the statesmen of the mother country to these distant lands, where now a branch of the Anglo-Saxon race is occupied in laying the foundations of an empire which, in centuries not far distant from our own, will be ranked amongst the first of the earth.

Although every intelligent inhabitant of this country honours the name of Captain Cook, would it not be possible to show this by another mark of our respect? and I therefore do not hesitate to offer a suggestion which I hope will be taken up and acted upon by our legislators. Hitherto, great confusion has prevailed relative to the name of this island, which is called both the Middle and South Island. The appellation Middle Island is a mistake, as the size of Stewart's Island precludes it from being ranked with the two others. The most eminent geographers of Great Britain and of the Continent of Europe —such men as Arrowsmith, Keith Johnston, Petermann, Hochstetter, &c.—call it always the South Island; while in New Zealand, even in official documents, it is called sometimes by the one, sometimes by the other name. In order to avoid further misunderstanding, would it not be appropriate to give this island the name of Cookland? for, so far as I am aware, no country visited by that illustrious navigator has been so designated; or in case of the Northern Island claiming that name, on the ground of its being the first part of the country where Captain Cook landed, might not another distinct name be given to it? D'Urville Land, Antipodæ, and Alexandra Land, having already been proposed. I should have suggested it should be called Tasman Land, had not the inhabitants of Tasmania rightly appropriated it to their island. However, I am quite content to have mooted the subject, and leave it in the hands of our legislators to move in the matter, which, as I believe, deserves some consideration at their hands.

I have to congratulate you upon the near completion of the new museum building, where it will be possible to find the necessary room for the proper arrangement of the collections belonging to the province, and to which the public has so liberally contributed; and I am proud to say that our institute may claim some little credit in the work of bringing about this desirable result, it having for several years urged the erection of a proper building upon the Provincial Government, and those of our members who also hold seats in the Provincial Council having likewise laboured in the same direction.

The report of your council, laid before you on the 8th of July in this year, justly points out that we all have cause to be satisfied with the advance made by the society during the past year with the accession of new members, and its general prospects in the future. Our principal aim being to promote the intellectual and material progress of Canterbury, a great deal still remains to be done towards accomplishing so desirable an object. At the same time I may claim the sympathy and assistance of the inhabitants of the province for our society, which can only progress when the province at large takes an interest in our doings and augments our ranks, so that we may gain more workers in the common field of inquiry. Will you here allow me to offer you my warmest and most sincere thanks for the honour you have done me in again electing me your president, and will you kindly receive my promise that I will endeavour to do my duty to the society to the best of my ability? I desire, however, to express a hope that you will allow me to retire at the next election into your ranks, giving place to some other member, who will be able to conduct the business of the Philosophical Institute more efficiently than I have done.

Although much has been discovered, and wonderful inventions have been made, a great deal of the general field of inquiry still remains unexplored; not to speak of the peculiar rewards which New Zealand offers to the student and lover of nature. Let us, therefore, strive to contribute our share towards the accumulation of those facts, by inductive reasoning, on which sound knowledge can only be gained, and however small the mite which we may be able to add, it will always be some addition towards the great mental edifice raised by the intellect of mankind to the glory of that First Intelligent Cause, in Whom all ultimate knowledge rests, Whom we vainly seek to conceive or to understand, and "in Whom we live, and move, and have our being."

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, JANUARY 17TH.—This meeting was a short one, and not of very much interest. Herr Helmholtz thanked the Academy for his election. M. Elie de Beaumont having read the correspondence of the day, a lecture was delivered by M. Duméry on the subject of railroads with a central rail. It was pointed out that this system had not yet been sufficiently extensively employed—the trial on Mont Cenis being a limited one—and yet that it offers many advantages, great economy in the working expenditure of the line would be obtained by this mode, and, in attaining the ordinary speed of 40 kilomètres an hour, the expenditure of coal would be about 48 centimes the kilomètre.

A memoir was presented by M. Maumené in support of a new chemical theory recently published by him, and which he complains that chemists high in the scientific world have not given a fair degree of attention to.

M. Brongniart then presented a note from M. Rose, relative to M. Prillieux's recent researches on the influence of light on the movement of the chlorophyll corpuscles. The motion of the chlorophyll corpuscles is not, he says, produced separately in each individual corpuscle. On the contrary, the light affects a mass of matter which incloses a number of corpuscles, and moves them bodily along with it.

M. Delaurier described some of the results of his researches on the electro-chemical theory. He believes that in chemical decomposition produced by heat the appearance of electricity is purely accidental. Further, he states that, with rare exceptions, the metalloids, whether solid, liquid, or gaseous, and whether combining with each other or with the metal, do not disengage electricity. He further seeks to explain why amalgamated zinc gives more electricity than ordinary zinc.

M. Jules Rouby gave a description of the method of producing artificial wells, and stated the conditions under which efforts in this direction should be made.

M. Bernard Renaud communicated some observations on the fossil plants, and especially the ferns of Cluny. His investigations upon the stems and fronds of the ferns of this region lead him to believe that the so-called ferns are really closely related to the Lycopodiaceæ.

The tables of the Academy were covered with specimens of a new species of workmanship in metal by Mr. Isaac Adams, of Boston, and called nickelization. Following up M. Becquerel's electro-chemical researches, Mr. Adams has succeeded in covering metallic objects with a layer of pure nickel of any required thickness. The failures in this process hitherto were caused, he thinks, by the use of very small quantities of alkalis. The most successful bath is, he finds, one composed of a neutral solution of a double salt of nickel and ammonia.

M. Becquerel remarked that he himself had always used the double salts of nickel and ammonia, and that in this way he had succeeded in getting thick layers of nickel and even cobalt and chromium.

M. Wurtz presented a note on behalf of Signor Rossi, of Turin, on the synthesis of propylic alcohol. This is the method. Ordinary ether is transformed into cyanide of ethyl, then, by known processes, propionic acid and propionic aldehyde are produced. Finally, this last is hydrogenized by M. Wurtz's method, and the alcohol is thus obtained.

M. Moehler, a Russian engineer, presented a geological map of the western part of the Oural mountains; the results differ very decidedly from those of Sir Roderick Murchison and M. Verneuil.

Replying to the objections raised by M. Dubrunfaut, M. Wullner described some very precise spectroscopic experiments, in which he proved that the gases in the capillary tubes, described by him recently, are pure gases. Their bright bands correspond exactly with the black bands of the solar spectrum, as mapped out by M. Angström.

M. Feltz contradicts the well-known recent experiments which seem to show that the white blood-corpuscles traverse the walls of the capillaries. He attempts to demonstrate the absence of apertures of the capillaries. We should like to know by what delicate method he effects such a demonstration.

M. Chevreul presented the first volume of the collected works of M. Millon, which are being edited by his former pupil and collaborateur, M. Reiset.

M. Delaunay having given a lecture on M. Puyseux's works upon the secular acceleration of the mean motion of the moon, the meeting terminated.

NOTES AND MEMORANDA.

Tolles' New Method of Illuminating Opaque Objects under High Powers.—A description is given in the *Monthly Microscopical Journal* of Professor Smith's plan and others, but the writer thinks that none of these methods have come into general use; the great difficulty with them has been that most of the light is reflected to the eye of the observer by the lenses, before reaching the object, thus producing a glare, which renders the object indistinct. By very careful and tedious manipulation, the writer has sometimes obtained a pretty good effect with Professor Smith's illuminator, but more often, after working a long time, has failed. Soon after Professor Smith's instrument was described, Mr. Tolles, then in Canastota, produced an instrument varying materially from the others. In this a prism is inserted in the side of the objective, between the front and middle combinations, of such a shape that a beam of light, received at the side of the objective, is thrown by a totally reflecting surface through one side of the front lens, at such an angle that none of it is reflected, but all passes through and is condensed on the object, and from that reflected back to the eye. Only one of these instruments (now owned by a physician of Boston) was then made. Recently Mr. Tolles has made two more of them, and their performance is such as to promise that little, if any, improvement can be expected in this direction. Opaque objects are seen with $\frac{4}{10}$ in. and $\frac{1}{4}$ in. objectives (from 200 to 500 diameters), brilliantly illuminated on a black background. The appearance of diatoms is similar to that obtained with the parabola, but the details of surface are shown with a distinctness never before seen. Of how much utility this is to prove, and what discoveries are to be made in the works of nature with it, are among the problems that the microscopists are called on to solve.

New Process of Photo-Lithography.—Mr. Francis, of the Athenæum Press, having secured the invention from Mr. Griggs, has, according to the *Builder*, introduced an entirely new method of producing copies of prints and pictures to the publishing world. The combination of photography with lithography was first attained by Sir Henry James, of the Topographical Department, but the process of Mr. Griggs claims to be a considerable advance on the original invention. Mr. Griggs takes a photograph of a print or picture in the ordinary way, but upon paper prepared in a manner only known to himself. The photograph thus taken is laid upon the stone and transferred, as in simple lithography, when it produces copies of the original picture with accuracy and clearness.

The New Coal Discoveries in India.—The question as to the precise character of the mineral discovered in the Kistnah district is at present attracting considerable attention, and *à propos* of it, the *Mining Journal* has received from Colonel F. Applegath, of Vizanagram (who it will be remembered, found and burnt coal at Jaggiapetta some years ago), a small specimen of the fuel, which may be examined at its office by those interested. The specimen forwarded is too small to permit of a decided opinion being formed respecting it, but Dr. Benj. H. Paul, F.C.S., to whom it has been submitted, states that it appears to possess all the characteristics of a lignite or brown coal. From the fact mentioned, that the sample is taken from near the outcrop, he considers it would not be possible to judge with certainty of the quality of the mineral as fuel, though it is probable it would prove very valuable in this respect, especially in India.

The Spectrum of the Fire-Fly.—The spectrum given by the light of the common Fire-fly of New Hampshire (Photinus?) is described by Mr. C. A. Young, in the current number of the *American Naturalist*, as being perfectly continuous, without trace of lines either bright or dark. It extends from a little above Fraunhofer's line C, in the scarlet, to about F in the blue, gradually fading out at the extremities. It is noticeable that precisely this portion of the spectrum is composed of rays, which, while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the Fire-fly is wasted. It is quite different with artificial methods of illumination. In the case of an ordinary gaslight the best experiments show that not more than one or two per cent. of the radiant energy consists of visible rays; the rest is either invisible heat or actinism; that is to say over ninety-eight per cent. of the gas is wasted in producing rays that do not help in making objects visible.

Permeability of Caoutchouc Tubes.—In a paper in *Cosmos* of December 25th, 1869, M. Jonant states that, from a series of experiments he has made, the following conclusions may be drawn:—A vulcanized caoutchouc tube of 1·2 m.m. thickness, and having a surface of 33·60 sq. m.m., loses, in three days, by diffusion, 21·3 per cent. of hydrogen, while 11·2 per cent. of air has at the same time entered. That the non-vulcanized caoutchouc tubing is by far less permeable for gases is proved by the following facts:—A tube of the last-named substance, having 50·00 sq. m.m. surface, has been submitted to the same experiment during twenty-eight days, and lost during that time, by diffusion, 22·6 per cent. of hydrogen, while only 5·6 per cent. of atmospheric air entered the apparatus, which was arranged precisely alike for both experiments, and so constructed as to indicate any change of pressure going on internally by means of manometer tubes. The permeability of caoutchouc for gases is a well-established fact, and a consequence of its peculiar structure.

Increasing Use of Nitrous Oxide Gas as an Anæsthetic.—From inquiries, we have been able to ascertain, says the *British Medical Journal*, that the use of nitrous oxide gas as an anæsthetic continues steadily to increase over the country, and that the amount made by manufacturers in London—chiefly by Messrs. Coxeter & Sons and George Barth & Co.—cannot be much under 60,000 gallons per annum, representing on the rough the production of anæsthesia in about 15,000 individuals. This increase arises almost entirely from its popularity among dentists. The gas has received comparatively little encouragement from surgeons. This may be easily explained by the great expense of the gas in even slightly prolonged operations, and the cumbrous nature of the apparatus required for its use. Its undoubted safety and rapidity of action, as compared with chloroform and other ethers, and the minimum of annoyance resulting from its after-effects, have been duly appreciated and practically recognized by dentists.

Vesuvine.—Under this name, M. Knosp has brought into commerce a dye material belonging to the class of aniline dyes, which is reported by a contemporary to be sold in the state of paste and powder. This dye yields shades of bright, as well as deep orange, and bright brown, and is suitable for dyeing silk, wool, and cotton; but this latter fabric has to undergo a series of mordanting processes before it is in proper state to receive the dye.

Utilizing the Printing Ink on Old Papers.—According to the Frankfort *Zeitung*, a discovery has been made by Herr Kircher, of Wurtemburg, of a new means of using old printing ink. The essential part of the discovery is that, by a peculiar process, the ink can be completely removed from the surface of the paper, at a cost of two shillings (one gulden) for every hundred pounds of printed paper, and, further, the material is then ready for use again.

How to Make Artificial Porphyry.—The *Chemical News*, giving an abstract of a recent paper by MM. Sepulchre and Ohressen, says that these *savants* have perfectly succeeded in utilizing the slag of the iron blast furnaces for the manufacture of paving-stones, which withstand a crushing weight of more than 400 kilos. per square centim., and have answered for the purpose of paving several streets at Brussels and Paris, and stood heavy traffic far better than even the celebrated Quenast stones. The streets paved with this material at Brussels have a heavy gradient.

SCIENTIFIC DIARY.

WEDNESDAY, January 26th.

Society of Arts, 8 p.m. "On the Modes of Reading in Use by the Blind, and the Means for Arriving at Uniformity," by Thomas Armitage, Esq., M.D.

Archæological Association, 8 p.m.

Geological Society, 8 p.m. "On the Crag of Norfolk and associated Beds," by Joseph Prestwich, Esq., F.R.S., F.G.S. "On the Fossil Corals of the South Australian Tertiary Deposits," by Dr. P. Martin Duncan, F.R.S., Sec.G.S. "Note on a very large undescribed Wealden Vertebra," by J. W. Hulke, Esq., F.R.S., F.G.S.

Philosophical Society of Glasgow, 8 p.m. "On the Scientific Principles affecting the Solvency of a Life Assurance Company, and the extent to which the Public can be protected against their Violation," by Mr. James R. Macfadyen, Fellow of the Faculty of Actuaries of Scotland.

Belfast Natural History Society, and the Belfast Naturalists' Field Club, 8 p.m. A Paper will be communicated by Mr. Robert W. Armstrong, of the Belleek Pottery Works, County Fermanagh, Illustrative of the Manufacture carried on there.

THURSDAY, 27th.

Royal Society, 8.30 p.m. "Observations on the Temperature of the Strata taken during the Sinking of the Rose-bridge Colliery, Wigan, 1868-9," by E. Hull, F.R.S. "On the Action of Rays of High Refrangibility upon Gaseous Matter," by Prof. Tyndall, F.R.S. "Remarks on the Recent Eclipse of the Sun as Observed in the United States," by J. N. Lockyer, F.R.S. "On the Theory of Continuous Beams," by J. M. Heppel. "Remarks on Mr. Heppel's Theory of Continuous Beams," by Prof. Macquorn Rankine, F.R.S.

London Institution, 7.30 p.m.

Society of Antiquaries, 8.30 p.m.

Zoological Society, 8.30 p.m. Prof. Owen will communicate a letter from Dr. J. Haast "On the Discovery of Cooking-pits and Kitchen-middens containing Remains of species of Dinornis, in Canterbury Settlement, New Zealand." Mr. G. Dawson Rowley, F.Z.S., will exhibit some birds.

Philosophical Club, 6 p.m.

Newcastle Chemical Society, 7.30 p.m.

FRIDAY, 28th.

Royal Institution, 9 p.m. Lecture by Prof. Odling "On the late Prof. Graham's Scientific Work."

Quekett Microscopical Club, 8 p.m.

East India Association, 8 p.m. "On the Delay of Justice to Indian Appellants in England: its Causes, Consequences, and Possible Remedy," by Mr. W. Tayler.

Clinical Society, 8.30 p.m.

Old Change Microscopical Society. Prof. Rymer Jones's last Lecture "On Comparative Anatomy."

SATURDAY, 29th.

Royal Institution, 3 p.m. "On Meteorology," by Mr. R. Scott.

MONDAY, 31st.

King's College, 8 p.m. "On the Prevalent and Fatal Diseases of the English Population from the Earliest Times to the Close of the 18th Century," by Prof. Guy.

Society of British Architects, 8 p.m.

Medical Society of London, 8 p.m.

London Institution, 4 p.m.

Institute of Actuaries, 7 p.m.

Philosophical Society of Glasgow, Chemical Section, 8 p.m. "On the History of Madder, the various Investigations relating to its Character and Composition, and the proposed Sources of Artificial Alizarine," by Mr. John Christie.

Torquay Natural History Society, noon. "On the Noachian Deluge," by the Rev. T. R. R. Stebbing, M.A.

TUESDAY, February 1st.

Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.

Institution of Civil Engineers, 8 p.m.

Pathological Society, 8 p.m.

Anthropological Society, 8 p.m. "On the Negro Slaves in Turkey," by Major Frederick Millingen, F.R.G.S.

Syro-Egyptian Society, 7.30 p.m.

Dr. B. W. Richardson's Lectures "On Experimental and Practical Medicine," 5 p.m., at 12, Hinde-street, W.

Leeds Philosophical Society, 7.30 p.m. "The 'Comus' of Milton," by the Rev. C. B. Eden, M.A.

WEDNESDAY, 2nd.

Society of Arts, 8 p.m. "On Recent Improvements in Small Arms," by Capt. O. Hea.

Pharmaceutical Society, 8 p.m.

Royal Society of Literature, 8.30 p.m.

Obstetrical Society, 8 p.m.

ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.—Professor Cope's communication has been received. We are much obliged to him. We shall be glad to receive from him a regular report of meetings, and notes of any novelties in the wide field in which he himself labours.

"THE BOOK OF BIRDS."—Messrs. Cassell's note has been received. We shall send a private reply in a day or two. The illustrations are excellent.

SOCIETY FOR ENCOURAGEMENT OF FINE ARTS.—The Secretary will please accept our best thanks for his kindness in forwarding the tickets.

L'HOMME PRIMITIF.—Messrs. Hachette's second letter has reached us and we are obliged for the trouble they have taken in the matter. Messrs. Chapman & Hall have also written to us. Their conditions shall be faithfully observed.

WATERPROOF HANGINGS.—In reference to our correspondent's inqui we beg to say that we will give an early notice of this ingenious invention.

PROFESSOR HUXLEY'S CELTS.—"H. H. S."—Thanks for your letter. Clearly the arguments did not leave a forcible impression on your mind, or you would have been able to reproduce them. We have seen the paper referred to, and the Devonshire man's productions. The whole view is speculative. There exist no statistics of a reliable character on the subject. We shall, however, be glad to publish anything "H. H. S." or any other courteous correspondent has got to say on the subject.

THE BUNCH GRASS.—We are much obliged to the editor of the *Farmer* for his prompt reply and kind promise. We shall be glad to receive the parcel as early as convenient.

FOREIGN GEOLOGY.—"G. A. L."—Already our arrangements are made with a well-known worker and writer. We hope, however, to send you something soon. Meanwhile, we shall be glad to receive an occasional note from you.

"BIRDS AND REPTILES."—Messrs. Chapman & Hall are thanked.

THE AIR METER.—"L. C."—It shall be noticed in an early issue.

UNDERGROUND RIVERS.—"B." is referred to our reviews in this number. The Mammoth Cave of Kentucky is beautifully illustrated.

MAGNETISM IN DISEASE.—"S. A."—The pamphlet was duly received. We do not think that our opinion of the views it contains would enhance either its sale or its author's reputation. The writer should consult the works of Duchenne, Becquerel, and the recent German treatise of Mayer and others. The literature is far vaster than he appears to be aware of.

LECLANCHÉ CELL.—"I. R. G. P."—As yet we have not been very successful. The current appears very feeble, and a metallic deposit on the zincode seems to interfere with the current. We shall say more when we have had it longer under notice.

DAMPNESS IN BEDS.—Apps in the Strand sells a sort of popular hygrometer for detecting the amount of dampness of beds.

DR. BASTIAN'S CEMENT.—"T. V."—Of Mr. Ladd, Beak-street, Regent-street.

RECORDING RAIN-GAUGE.—"Meteorologist."—Apps has a good instrument of the kind; it is his own invention, we believe.

A THEODOLITE FOR TRAVELLERS.—"F.R.G.S."—We believe that the little apparatus sold by Casella, of Hatton Garden, is about the best. Call and see it.

THE MECHANICS OF THE SEWING MACHINE.—"A Governess."—The electro-magnetic method has not been used. Lenoir's gas-engine would be a simple and not expensive power.

OPIUM IN TOBACCO.—"H. T. W."—It is said to be in Manillas. The last number of the *Chemical News* in its answers to correspondents gives a method of detecting opium in tobacco.

NOTICES.

ALL persons failing to obtain a regular supply of this journal through their local agent may insure its prompt receipt upon the day of publication by forwarding their name and address to the publishers, at 75, Great Queen-street, together with a remittance in accordance with the subjoined modified scale of subscription (which includes postage), viz.—

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WEDNESDAY, FEBRUARY 2, 1870.

THE CHAIR OF BOTANY IN THE ROYAL COLLEGE OF SCIENCE, DUBLIN.

IT is regarded in this country as one of the stereotyped misfortunes of Irish science that the Government appointments to scientific chairs in the sister island are almost invariably what are vulgarly styled jobs. Certainly, the history of the selection of candidates for many of the chairs in the Queen's Colleges would appear to justify this view, and now we hear of another instance in which, as it seems, a very flagrant injustice has been done to the claims of Irish scientific men. We last week briefly alluded to the appointment of Mr. Dyer, of Cirencester College, to the vacant chair of Botany in the Royal College of Science, or Museum of Irish Industry, as it used to be styled. We mentioned at the same time that the opinion of the Irish press was very strongly expressed upon the subject, and that it altogether disapproved of the selection which the Government has made. We shall now lay before our readers a few of the facts connected with the case, so that they may see the grounds on which it is alleged that the Kensington authorities have acted unfairly towards Irish science.

The Royal College of Science, as it is now styled, is an institution established some years since in Dublin, in connection with the Science and Art Department of the Committee of Council on Education, and is placed under the direction of Sir Robert Kane. It is situate in a commanding position in Stephen's Green, has a very excellent and well-lighted museum, a good library, a fine lecture-theatre, and a very fair staff of Professors. It originally sprang out of the desire to develop the national resources of Ireland, as set forth in the treatise of Sir Robert Kane, which attracted so much attention in the year 1845, or thereabouts. Those who are familiar with the Jermyn-street School of Mines will at once understand the importance of the Irish Institution, when we tell them that the Royal College of Science is on the whole a larger and more commodious, if not a better arranged, scientific establishment than its sister in London.

But it has happened unfortunately in the case of the Irish school, as in that of the London one, that a niggard Government has not sufficiently endowed the several chairs. If we remember aright, the chairs of Botany and Zoology, which were originally one, have an annual emolument of £200. Since the division of the lectureships, which occurred at the time the late Dr. Harvey held the chair, the yearly income from each has been about £100. Now it is needless to say that no scientific man, without private means, could possibly subsist upon a salary of £100 a year, and carry on researches and provide himself with the literature and apparatus requisite for original investigation. It has, therefore, been found necessary in Dublin—as it has been in London in the case of some of our very first men of science—to arrange that the tenant of the chair in the College of Science should be also the tenant of the chair in the University of Dublin, and by this means to provide a salary sufficient to induce men of ability and distinction to hold the Professorship in either. The first who held the two chairs was Dr. Allman, who is now Professor in the University of Edinburgh. After him came the late Dr. Harvey, one of the most illustrious botanists, as he was certainly the most eminent algologist, of his time. On the death of Dr. Harvey, the united offices were held by Dr. Alexander Dickson, a gentleman whose numerous valuable researches in the field of physiological botany are too well known by our readers to need any comment of ours. Dr. Dickson's reputation as a botanist soon obtained for him the chair of Botany in the University of Glasgow, and thus once more the two Irish posts became vacant.

At this time—not very long since—Professor Wyville Thompson, of Queen's College, Belfast, was requested by the Government to accept the Chair of Botany in the College of Science. This, however, he hesitated to do, because he was aware that necessity and precedent both required that, if he held the Government chair, he should also hold that of the University of Dublin; and he declined to be a candidate for the latter, because he considered that Dr. E. Perceval Wright—whose labours in connection with the *Zoological Record*, and for many years in the Trinity College Museum, are well known to naturalists—had the highest claims for the University Professorship. The Kensington authorities, on learning the decision of Professor Thompson, determined to remove his qualms of conscience. They made some underhand and unofficial inquiries of those "high in influence" in Trinity College, Dublin, and it appears they were informed that the "Board" was not likely to give the chair to Dr. Perceval Wright. Upon this understanding, Professor Thompson accepted the post in the College of Science, and quietly awaited his chance of being elected to the Botanical Professorship in the Dublin University.

It happened in course of time that the selection of the Board of Trinity College, Dublin, fell on Dr. Wright, and thus a somewhat anomalous condition of things existed—Dr. Wright holding the University and Dr. Thompson the Stephen's Green Chair. Of course, Dr. Thompson soon resigned a post which he felt really belonged to his colleague, and which, from a pecuniary point of view, was really not worth possessing separately; and, under these circumstances, it was expected that the Government would have been politic and gracious enough to have given the Professorship to Dr. Wright, to whom by all law of precedent and every rule of expediency it unquestionably belonged. But, to the astonishment of our friends in Dublin, the South Kensington authorities, with a will, if not with a wisdom, of their own, allotted the chair in the College of Science to another gentleman, and to one, we may almost say, untried and unknown. *Hinc illæ lachrymæ* on the part of Irish journalism; and need we be surprised that it is so?

On the whole, then, we think the representatives of Irish science have three claims on our consideration, and are certainly to be regarded as aggrieved on these three separate points—1st. That the two chairs were separated at a time when in all other institutions (the Queen's Colleges to wit) amalgamation is the rule, for the very reason we have alluded to. 2nd. That an English has been selected in preference to an Irish botanist; and lastly, that an Englishman being selected, one has been chosen who, however industrious and however likely to adorn the office in the future, brings no lustre or eminence to the institution to which he is attached, and certainly has had no claims in comparison with those of certain of the other candidates. We have no desire to say anything to offend Mr. Dyer, who is an industrious if not a distinguished botanist; but we certainly must confess that his selection for the chair to which he has been appointed in preference to some of the other candidates, fills us with an astonishment which we did not think even the Kensington authorities could have excited in our minds.

THE Scotch agriculturists have had the reputation of being more scientific than the English, and certainly the recent report of the secretary to the "Highland and Agricultural Society" would justify this view. In speaking of the chemical department he says:—"I believe I may say that in no previous year has the work been so large and varied. The number of analyses made for members of the society has amounted to no less than 372, embracing the analyses of soils, waters, manures, feeding stuffs, and, in fact, all the ordinary articles of agricultural consumption." This exceeds the analyses made by Dr. Voelcker for the Royal Agricultural Society, although the number of members of that society exceeds that of the Highland Agricultural Society by more than 1,000.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

ABOUT a month ago we announced the death of Mr. Walsh, the eminent entomologist, in America, and we stated what perhaps is not generally known, that Mr. Walsh was an Englishman who many years ago emigrated to the United States. The *American Entomologist*, of which he was joint-editor, now gives us further details of the melancholy accident which brought about Mr. Walsh's decease:—On Friday, the 12th of November, he started in excellent spirits on his usual morning walk to the post-office, and on his return, while walking towards Moline, on the track of the Chicago and Rock Island Railroad, he suddenly noticed the passenger train for Chicago slowly nearing him. Stepping aside, he continued his way on what he supposed was a side-track, which however proved to be the track down which the train in reality came, though he did not discover his mistake until the engine was close upon him. He now had no time to get off the track, and with great presence of mind, flung himself bodily as far away as possible, with the intention, as he afterwards related, of saving his body at the expense of his limbs. Unfortunately his left foot got caught and terribly mangled. The engineer succeeded in stopping the train before the driving-wheels of the locomotive had touched the foot, and Mr. Walsh was taken on board and carried back to the depot, whence he was conveyed to his home. The foot was amputated, and for a few days it did well; but the case took a serious turn, which the physicians thought resulted from shock, and on the 18th of November Mr. Walsh died. Mr. Walsh's fine entomological collection is for sale.

The valuable chair of Physical Science in the University of Dublin is to be conferred by competitive examination. Two of the candidates have protested against the addition of chemistry to the other subjects of examination.

THE book on Brazil, by Professor Agassiz, announced some time since as in the press, will, we understand, be very shortly published.

WE regret to announce the death of a young chemist and naturalist of much promise, Mr. A. Payton Hurlstone. Mr. Hurlstone died on the 21st of December on board the ship *Laplace* on his voyage from the Brazil. He had only reached the age of twenty-four, and yet was a member of the College of Surgeons, and Bachelor of Science and of Medicine of the University of London.

WHAT about the German expedition to the North Pole? M. Petermann states that he has received no news of the expedition since August last!

CAPTAIN DOUGLAS GALTON has been appointed to the Directorship of Works and Buildings, a new office under the First Commissioner of Works. This is an example of the right man in the right place. Captain Galton has done good service to practical hygiene, and he is one of the few in this country who understand the true principles on which ventilation of buildings should be conducted.

THE promoters of the scheme of a university education for women at Cambridge have definitely arranged the following course of lectures for the present term:—English language and literature, by Mr. Skeat, Tuesdays and Thursdays; Latin, by Mr. Mayor (St. John's), Tuesdays and Thursdays; French, by M. Boquel, Wednesdays and Fridays; Logic, by Mr. Venn (Caius), Wednesday; and Algebra, by Professor Layley, Monday and Wednesday. Besides these are Professor Maurice's lectures, Wednesday and Friday, which will not commence for three weeks, and one or two other courses which are not quite settled.

"FORCE *versus* Organization" is the title of a clever philosophical essay in the current number of an interesting provincial monthly, *St. Cuthbert's Magazine*.

THERE is still news of the discovery of diamonds in Australia. The *Melbourne Argus* of December 7 says:—An auction sale of diamonds from the Mudgee districts was held in Melbourne the other day. This event was announced to be the precursor of a series of sales of the same kind in this city. Few of the stones disposed of on this occasion were of any respectable size, and none of them of a very good colour. The produce, however, seems to be increasing in what is now recognized as the "diamond district."

WE mentioned last week that two Scotch professors were determined to meet the "anatomical" wants of the strong-minded women of the day. We are now enabled to state that the two gentlemen so far in advance of the age are Dr. Struthers, of Aberdeen, and Dr. Bell, of St. Andrew's.

DR. FRANKLAND speaks in very disparaging terms of the East London Company's water. He declares it to contain much suspended brown matter, full of living organisms, and especially of vibriones.

ONE of the practical applications of zoological knowledge in America, is the study of the insects injurious to crops, in order to determine their larvæ, and thus prevent their increase. State Entomologists have been established in several parts of America, and now a new appointment is about to be made for Minnesota.

AN Otago (New Zealand) paper reports that a bed of guano of considerable extent has been discovered by some Chinese on the other side of the precipitous range falling into the Molyneux, a short distance from that township.

THE second course of Cantor Lectures of the Society of Arts for the present session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at eight o'clock. These lectures are open to members, each of whom has the privilege of introducing two friends to each lecture. Tickets for this course will be issued shortly.

GOVERNMENT has made a new chemical appointment in electing Mr. W. Chandler Roberts "Chemist to the Mint." Mr. Roberts had for some time been assistant to the late Master of the Mint, Professor Graham.

THE *Gardeners' Chronicle* is about to open a new department in its pages, which will be of great interest not only to botanists and gardeners, but also to scientific men generally. Mr. Glaisher will contribute to the *Chronicle* a record of the meteorological phenomena for the week, as observed at Blackheath, and also a summary of the state of the weather in various parts of Britain. The editor promises shortly to advert to the whole subject of the relations of meteorology to vegetation.

THE facts elicited at the trial of Tropmann for the murder of Kinck are of considerable chemical and medico-legal interest. The *British Medical Journal* says that according to the evidence of Professor Roussin sulphate of iron, Prussian blue, and an alkaline sulphate, were found in the stomach. These were accounted for by the rudimentary process Tropmann adopted

to manufacture his hydrocyanic acid. Ferrocyanide of potassium and sulphuric acid were used; but he was unable to prevent the formation of incrustations of sulphate of potassa and sulphate of iron. In addition, there was formed a white substance, which turned blue on exposure to the air. All these substances were found in the stomach. Some of the Prussian blue was handed round at the trial.

A NEW form of cabbage called the Sandringham has made its *début*. Its head is like a small-sized cabbage, and its stem is covered with small heads like Brussels' sprouts, but larger. It is the result of a cross between two other forms.

MISS BURDETT COUTTS was last week elected a member of the Highland and Agricultural Society.

A PROPOS of appliances, scientific and otherwise, for the protection of life from fire, Captain Shaw, of the Fire Brigade, has written a very sensible letter to the *Times*, to which we direct our readers' attention. After giving various hints of great service, he thus sums up:—In case of fire, give the alarm at once, and make every effort to escape and to save others by whatever mode of egress may be available; but in doing so, remember to shut and keep shut all doors, windows, and apertures of every kind through which air can be admitted, thus checking the combustion and giving all concerned more time to get out, or, failing this, to come and show themselves at a front window or other prominent point accessible to our ladders. In short, all persons endangered should rely on their own resources during the first moments of an alarm, and after a period which they can calculate for themselves, according to the locality in which they live, they may expect an attendance of firemen with proper appliances, and the skill and energy to use them to the best advantage, regardless of all personal risks so long as there is a hope of saving life or property. In one word, the public may rely on us to a very great extent, but must not do so altogether, as, in many cases, our success or failure depends absolutely on what they themselves do, or omit to do, previously to our arrival.

As an antidote to Sir Joseph Whitworth's views on flat-headed shot, we may refer our readers to a letter in the *Times* by Captain Palliser, of chilled shot celebrity. Captain Palliser tries to show that his shot has not been fairly tested, and that the Whitworth guns are not required for the purpose. The Captain concludes his letter, with a truism of the most Hibernian character, when he says, speaking of Government interference, "This unwarrantable interference would not seem to rest on justifiable grounds." We should think not indeed, if it is unwarrantable.

MR. G. J. SYMONS calls attention to a blunder common among amateur meteorologists, but one which is really inexcusable. It is the common reference to the freezing point, 32° of Farenheit's thermometer, as zero. He gives the following shamefully inaccurate report as furnished by the Sydenham authorities:—"Crystal Palace.—With a clear sky, and almost total absence of fog, the frost has been very severe at the Crystal Palace, the thermometer registering at night 10° or 12° below zero."

WE learn from the *Athenæum* that the Rev. A. E. Eaton, of Trinity College, Cambridge, is preparing a monograph on the Ephemeridæ, or May-flies, in two parts. Part I. (which will treat of their generical and special nomenclature) will contain a chronological catalogue of authorities and a synonymic alphabetical index to their works, descriptions of the known genera and species, and figures of some organs characteristic of the genera and drawings of many of the species. Part II. will be occupied with an account of the anatomy and development of one, or more, characteristic British species.

THE following important notices reach us from the University of Oxford:—The Sadleian Professor of Natural Philosophy (Rev. Bartholomew Price, M.A.) will lecture during the present Term on Optics, Geometrical and Physical. His lectures will be given on Tuesdays, Thursdays, and Saturdays, at 1 p.m., and will commence on Thursday, February 3. They will be at the Lecture-room, University Museum. The Professor of Experimental Philosophy (R. B. Clifton, M.A.) will in the course of the present Term continue his course of lectures on Heat. His lectures will be on Mondays and Thursdays, at 12 o'clock, and will commence on Monday, February 7. They will be given at the University Museum. The fee for these lectures is £1. The Professor of Geology (J. Phillips, M.A.) does not purpose to give lectures this Term. The Professor of Chemistry (Sir B. C. Brodie, M.A.) will lecture during the Term on Tuesdays and Saturdays, at 11 a.m. (A syllabus of these lectures may be obtained on application at the Laboratory). He will also give a catechetical lecture on Thursdays, at the same hour. His course begins Saturday, Feb. 5. Both lectures will be given at the University Museum. The Demonstrator of Chemistry (Heathcote Wyndham, M.A.) will give a course of lectures "On the Methods of Quantitative Analysis." These lectures will be in connection with a practical class on the same subject, and will be given on Mondays, Wednesdays, and Fridays, at 10 o'clock, commencing on Monday, February 7. A course of elementary practical instruction in chemical manipulation, intended for students commencing the study of chemistry, will also be given. The laboratory of the University will be open daily for instruction in practical chemistry, from 9 a.m. to 3 p.m., on and after Saturday, January 29. The fee for working during the Term for three days in the week is £3. 10s. The Professor of Botany and Rural Economy (M. Lawson, M.A.) will continue his catechetical lectures every Wednesday during Term, at 8 p.m., in the Herbarium. The course will begin on Wednesday, February 2, and is open to all members of the University. The Regius Professor of Medicine (Henry W. Acland, D.M.) will lecture during the Term on Clinical and General Medicine. His lectures will be given at the Infirmary, on Mondays at 9, and Saturdays at 11, and at the Museum on Mondays at 11. They will commence on Monday, February 14. The Professor will attend in the Medical Department of the Museum at 11 o'clock on every Monday, from February 14 to March 17 inclusive, to confer with members of the University on any subject connected with medical studies or education. Instruction will be given at the Medical Laboratory in certain departments of Pathology and State Medicine, by Charles C. Pode, M.B. Application to be made to the Professor, on any Monday, as above. The Linacre Professor of Anatomy and Physiology (G. Rolleston, D.M.) will deliver during the present Term a course of lectures on Physiology. This course will be delivered at the University Museum on Tuesdays and Fridays at 1, and on Saturdays at 12 o'clock. The Linacre Professor proposes also to form classes for practical instruction, as in former Terms. Persons who join these classes will come to the lectures on Saturdays at 12 o'clock, and will also come to the Museum on two evenings in the week for study and demonstration. The Professor of Zoology (J. O. Westwood, M.A.) will lecture during the present Term on the orders of *Hexapod annulosa*. His lectures will be given on Wednesdays and Saturdays, at 12 o'clock, and will commence Saturday, February 12. They will be at the University Museum.

Two prizes, of the value of £10 and £5 respectively, have been offered by Major Trevor Clarke to the exhibitor (whether amateur or nurseryman) who may, during the year 1871, obtain the largest number of marks for specimen plants illustrative of the phenomena of hybridization shown at the meetings of the Royal Horticultural Society. In awarding the marks, the judges will be instructed to consider the following points:—1. Crosses hitherto unattempted. 2. Results of great horticultural excellence. 3. Results of great botanical or physiological interest, as, for instance, between supposed genera or distant species. 4. Results well illustrating the effects of hybridization. 5. Plants raised by the exhibitor. 6. Difficult or supposed impossible unions. 7. The largest meritorious exhibitor

of hybrid plants during the season of 1870. The plants should, if possible, be accompanied by both parents, or at least one. Plants may be shown as cut specimens where removal of the whole plant is impracticable. The plants may be shown as cut specimens in water.

THE Council of the Society of Arts have decided to offer the Society's Gold Medal for an improved ship's lifeboat. The terms and conditions of the offer are referred to a committee to settle.

A NEW ZEALAND correspondent expresses a hope that, as the Government is now considering the preparations for observing the transit of Venus in 1874, and as New Zealand is to be one of the proposed stations, due attention will be given, in selecting the exact site of the temporary observatory, to the great variety of climate on different parts of the coast. As there are now meteorological observations conducted on a uniform system in every part of the islands, and the results are reduced and published with regularity, there should be no difficulty in making a proper selection. In connection with this subject, he states that since the telegraph has been extended to most of the principal towns, one uniform time has been adopted, and an observatory has been lately established by the Government in Wellington, from which the correct time is transmitted by telegraph in all directions. As the meridian difference of this observatory from Sydney and Melbourne will be shortly ascertained, it will thus be possible to determine with facility the exact longitude of any place in New Zealand that may be selected by the managers of the Astronomical Expedition of 1874.

A VERY important letter from Dr. Tyndall, in reply to the criticism in our leading article of last week, will be found among our correspondence.

FATHER MERMILLOD, a French preacher, who is creating some sensation in Rome, says that the Church of Rome deserves the gratitude of scientific men!! He illustrates this by asserting that Rome has ever been the patron of Science, and that she has done her utmost to put down the two false philosophies, Spiritualism and Darwinianism. This last is certainly complimentary to Natural Selection!

AT a meeting of miners, held at Ashton-under-Lyne on Saturday, resolutions were passed in favour of an Act for securing proper inspection and ventilation of mines, and for preventing the employment of young children in collieries.

THE *New York Herald* gives us an example of the terrible momentum acquired by a huge iron ship well under weigh. It says that the terrible force with which a blow can be dealt by a double-turreted *Monitor* was shown by the *Miantonomoh* in the sinking of the *Maria* on the night of the 3rd inst., while *en route* to Boston. She was steaming at the rate of seven miles an hour when she ran into the steamer *Maria* off Cape Cod. The *Miantonomoh* struck the *Maria* about midships, pressed her bow completely through the side, forced the engines out through the other side, and lifted the wooden steamer up on her bow like a broken eggshell. The steamer remained a few minutes on the bow of the *Miantonomoh*, and was carried with the greatest ease. Soon it was shaken off, filled with water, and sank immediately. Four lives were lost. It is calculated that the Monitors *Miantonomoh* and *Terror*, now at Boston, have an impetus, when under a speed of seven knots, equal to about 60,000 tons.

THE Lords of the Admiralty have just issued a notice to the effect that large numbers of icebergs and detached masses of ice have recently been fallen in with by vessels homeward bound round Cape Horn, extending in the 42nd meridian of west longitude as far north as the parallel 42½° south latitude. And masters are recommended that, in taking this route, they should sight, or pass a moderate distance eastward of the Falkland Islands, and should not steer eastward of a N.E. by N. course (true) until northward of the parallel of 40°. The notice also states that, as it appears there are exceptionally large quantities of ice now adrift in the South Atlantic, vessels bound eastward round the Cape of Good Hope should keep a sharp look out.

MR. HARRY LOBB, a gentleman who calls himself a "Surgeon-electrician," whatever that may be, in advertising one of his pamphlets, gives as a quotation from our columns, a testimonial to his battery which he must have composed for himself. We know nothing of Mr. Lobb's batteries, and we never passed an opinion on them in our lives. We trust, therefore, that Mr. Lobb will offer us some apology, for his gross misconduct in using the following statement as a pendant to one of his advertisements:—"This apparatus of Mr. Harry Lobb is the most perfect battery for medical purposes that has appeared, and can hardly be excelled."—*Scientific Opinion.*

THE question of mixed education in Ireland has been discussed, in a work just issued by Messrs. Longmans, and written by a Mr. F. H. O'Donnell, M.A. We shall hope to deal critically with the authors arguments in an ensuing number.

ON Friday, the first number of a new journal, the *Oxford University Gazette*, made its appearance. It is to be published every Tuesday during term, and at such other times as the exigencies of the University business may require. The questions set in the several public examinations are to be published in supplements, one of which is issued with the present number, containing the examination papers of the second public examination, of the Michaelmas Term, 1869.

THE foundation-stone of a new Mechanics' Institute in Bridge-street, Bradford, was laid last week by Lord Houghton, in the presence of a large assembly, which included a great number of ladies. His lordship was accompanied to the site by a large number of gentlemen, amongst whom were the Rev. Dr. Campbell, the president of the institute; the Mayor of Bradford (Mr. Mark Dawson); Mr. Edward Miall, M.P.; Mr. A. Illingworth, M.P.; Mr. H. W. Ripley, &c.

THE curious new ship on the turret principle, the *Captain*, some time since described in our pages, left the Mersey on Saturday morning for Portsmouth. We shall be interested in hearing of her sea-going qualities.

THE Director of the Radcliffe Observatory at Oxford has issued a new catalogue of stars, compiled from observations between the years 1854 and 1861. The number of stars included is 2,386, and their places are reduced to the 1860 equinox.

THE latest discovered asteroid, that found by Professor Peters, at Clinton, New York State, has been christened by its discoverer with the happy, if not obviously appropriate, name of *Felicitas*.

MR. W. CHADWICK, B.A., of Merton College, and late postmaster, has been elected to the vacant (Mathematical) Fellowship at Corpus, Oxford. Mr. Chadwick obtained a Mathematical First both in the "moderations" and in the final examination. He also gained the Junior Mathematical Scholarship.

CAPTAIN THE HON. E. COCHRANE, H.M.S. *Petrel*, on the west coast of Africa, writing on Jan. 9, says, "Dr. Livingstone has been killed and burnt by the natives, 90 days' journey from Congo. . . . . I believe this news to be true."

THE new Professor of Dermatology at the Royal College of Surgeons (Mr. Erasmus Wilson, F.R.S.) commenced his interesting course of lectures on Monday. In illustration of the first lecture, there were a large number of exquisitely-prepared models, duplicates of those prepared for the Hôpital St. Louis, Paris, which attracted well-deserved attention from the large and distinguished party assembled to hear the learned dermatologist. The chair was occupied by Mr. Edward Cock, the

President, supported by the Vice-Presidents, Mr. Solly and Sir William Ferguson, and many members of the Council and past Presidents, as Messrs. Hilton, Partridge, and Quain. The veteran artist, Mr. George Cruikshank, Mr. Hepworth Dixon, and other literary celebrities, were also present. At the conclusion of Professor Wilson's course he will be followed by Professor Flower, F.R.S., Conservator of the Museum, who will deliver eighteen lectures introductory to the study of the anatomy of the class Mammalia.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

BRIEF REMARKS ON THE BIOLOGY AND GENEALOGY OF THE MARANTACEÆ.[1]

BY FEDERICO DELPINO.

IN TWO PARTS.—PART I.

ER. FREDERICK HILDEBRAND, Professor of Botany in the University of Freiburg (Baden), to whom we owe the discovery of many remarkable floral apparatus for the effectuation of Dichogamy,[2] writes, in his letter of the 8th of August, as follows:—

"I have been able to discover several novelties in the study of Dichogamy. For example, a very singular apparatus for the impollenization of *Maranta Zebrina*, where the pollen, before the opening of the flower, is deposited in a concavity which is found at the apex of the style. After the flower opens the style is found in such a position that when the petal which wraps it round is pressed, it bursts loose suddenly; and thus the pollen is carried on to the body which caused the pressure, and is afterwards rubbed off by the stigmas of the subsequently visited flowers during the same sudden escape of the style."

In consequence of this interesting notice, I proposed to study *M. Zebrina*, but could only get specimens of *M. bicolor* and *M. cannæfolia* in flower.

In both species I observed the sudden escape of the style, which is effected in identically the same manner as that described by Professor Hildebrand.

The apparatus, according to my observations on these two *Marantaceæ*, merits careful study and circumstantial description, which I shall attempt in the following pages.

The flowers of the Marantaceæ have become extremely irregular. Irregular flowers ought to be at least laterally symmetrical; but the Marantaceæ have lost all symmetry.

We adopt the term irregularity to follow common usage, but we entirely repudiate the signification of the word, as so-called irregular flowers constantly show signs of an extreme degree of morphological and biological perfection. And if this may be said of symmetrical irregular flowers, still more is it the case with those that have lost symmetry also. Therefore we may be prepared to find a singular biological perfection in the Marantaceæ.

When we consider them purely under a material and organographical point of view, we shall nowhere in the whole vegetable kingdom find flowers more transformed and extraordinary; therefore the right morphological interpretation of the parts is extremely difficult. The insertion of the organs is profoundly disturbed; to this is added an unequal adherence and fusion of the organs; and this again is complicated by the abortion of organs and parts of organs; and to crown this confusion there are petaloidal degenerations in all the stamens.

Comparative morphology, assisted by the doctrine of the variability of species, enables us to throw light on the morphological interpretation of the flowers of the Marantaceæ. We must compare the flowers of Strelitzia, of the Zingiberaceæ, of the Marantaceæ, of the Cannaceæ, and of the Orchidaceæ.

In the genus Strelitzia it is not difficult to see the order of the flower as it preserves perfect symmetry and a certain simplicity. Three sepals alternate with three petals, one of the latter being transformed into a cover for the nectary (*nettarotegio*), the other two forming a singular pollenical sheath or box, which can be opened only by the insect fertilizer. Five stamens, normally anthered, and a long style are situated lengthways within this sheath.

We must bear well in mind that in the Strelitzia, as well as in the other Musaceæ, there do not exist more than five stamens, one being completely aborted. Remembering this fact, we need not give ourselves the useless trouble of trying to find six stamens in the families which descend from the Musaceæ (that is, in the Orchidaceæ, Zingiberaceæ, Cannaceæ, Marantaceæ); and the attempt of those botanists who will insist upon finding hexandria in the type of the above-mentioned families—that is, a character which is not found even in their parent stock—appears fruitless.

This premised, let us pass to the Zingiberaceæ; let us, for example, examine the flowers of the *Kœmpferia longa*, Jacq. It is not difficult to find perfect homology in the flowers of the Kœmpferia with those of Strelitzia; that is so say, morphological, not biological, homology, since the dichogamical apparatus is quite changed.

The three sepals are distinguishable at first sight. The three petals are quickly recognized, if in no other way, at least by their perfectly alternate insertion with the three sepals. But in the Zingiberaceæ, as these petals do not serve the special biological purpose of those of the Strelitzia, they reacquire a quasi-normal form, whilst in the Strelitzia their forms are extremely abnormal. In Kœmpferia and in the other Zingiberaceæ we find the five stamens strangely metamorphosed, which, on the contrary, in the Strelitzia are normal. Four assume the form, the appearance, and the function of petals. Two of these four are united to form a kind of labellum,[3] often bilobed. The fifth stamen is much elongated, and is profoundly furrowed, not only along the whole filament, but along the connective. The whole length of the style is enveloped in this profound furrow in such a way that the stigma emerges from the extremity and is placed above the apex of the anther, thus making impollenization impossible without the intervention of special insect fertilization.

We thus show that not one of the floral organs of the Strelitzia and other Musaceæ is wanting in the Zingiberaceæ.

The morphological and genetical transition from the Zingiberaceæ to the Marantaceæ and Cannaceæ can be seen without difficulty. In this genealogical research, moreover, to those who have set out in the true road, a most beautiful teratological case has been offered in a flower of *Alpinia nutans*.

The Alpinia, like all the Zingiberaceæ, has a bilocular anther. Now, in the above-mentioned monstrous flower, one lodge is aborted, and the corresponding part of the connective is extraordinarily elongated and dilated, assuming a petaloidal form. In short, that which has happened accidentally in this flower, takes place normally in the Cannaceæ and Marantaceæ, *where one of the five stamens inherited from the Musaceæ becomes petaloidal like the other four, one lodge of the anther*

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[1] "Breve Cenno sulle Relazione Biologiche e Genealogiche delle Marantaceæ," di Federico Delpino (*Nuovo Giornale Bot. Ital.*, vol. i. No. 4, 1869).

[2] This term, Dichogamy, was first used by C. C. Sprengel to express the remarkable fact, that in many hermaphrodite flowers the male and female elements are not matured at the same time, so that these flowers must be crossed with another flower on the same plant, or on a distinct plant. The anthers are generally mature before the stigma; but in some few cases the stigma is mature before the anthers. The crossing is usually effected by insects, and such flowers are called by Delpino Entomophilous.—ED.

[3] Properly speaking, according to the data of the biological and dichogamical doctrine which we are defending, the labellum serves at once a double function, that of signal-flag (to attract the insect-fertilisers with the brightness of its colour), and the function of support (to give them a convenient landing-place for sucking the honey).

This labellum might be taken for a single organ in the Zingiberaceæ; but, after having indicated the origin of it in the *Globba bractsolata*, we may be sure that it is double in reality. Wherefore, it ought to be still considered as two stamens metamorphosed into petals and united laterally.

sterile, the other bridge dentiform, folds longitudinally, and in its folding embraces the style.

It is only with these premises that we can give a satisfactory explanation of the true morphological signification of the floral organs of the Marantaceæ, notwithstanding the extreme perturbation to which they have been subjected.

Coming first to Maranta bicolor, we find that its flowers and all its floral parts preserve a complete morphological homology with the flowers of Strelitzia.

Three petals always alternate with the three sepals, though *dissimilarly*. We find again the five stamens, but they are all, including the pollen-bearing one, petaloidal. Besides this, they differ externally from each other. Two are dilated and soft; one is fleshy and rigid; the fourth is folded, and on one side carries a callosity surmounted by a tooth; the fifth is semi-antheral.

With considerable trouble I discovered the morphological value of these greatly metamorphosed parts; but if I should ask a morphologist pure and simple to explain the why of this metamorphosis, I know I should cause him great embarrassment. But for the biological morphologist it is quite apparent, and a most singular dichogamical apparatus is revealed.

The flowers of the *Maranta bicolor* have assumed the general character of the papilionaceous type.[4]

The two petaloidal and expanded stamens, inclined towards the lower lip, have the functions of signal-flag and landing-place; the stamen, having a thick and rigid consistency, is situated at the upper lip, and forms a kind of vault, marked across with a particular dark spot (the guide to the nectary, according to C. C. Sprengel), and has thus taken the function of indicating and constituting the entry to the nectary.

The nectary is formed by a tube proceeding from the soldering of all the floral parts at the base. The nectary gland is a salient glandulous point, which lies in the bottom of the nectary.

The fourth stamen, folded along its whole length, and unilaterally provided with a callosity surmounted with a tooth, has an extremely important function, which comprises in itself the soul of the apparatus.

The style when very young and still growing is straight; but by degrees, as it develops, the cells of the upper part increase somewhat differently from those of the lower part, acquire an extreme tension, in such a manner that its natural position would be, if at liberty, a spiral coil in one plane. But as it is closely embraced by the above-mentioned fourth stamen, which has the function of a retainer and keeps it extended, it is therefore obliged to remain in a straight position.

The callosity, which the fourth stamen carries at one side, is chiefly of use to maintain the style in this forced position. This callosity is placed astride on the style, and prevents it escaping and coiling in a spiral. The fact that this callosity is surmounted by a tooth must be kept in mind.

The fifth stamen, which bears half an anther, finishes its work before the opening of the flower. It is applied in an early stage to the neck of the style, where a small depression is found; the half-anther, which is dehiscent before the opening of the flower, sheds all its pollen into this same depression. The stigma is lateral, but, although close to the depression in the style for collecting the pollen, is separated from it by a short space, which is covered with white viscous matter.

After the flower is open, the apparatus is all ready. The landing-place for the approach of the insects, as well as the style, bound and incarcerated by the fourth stamen, are situated in the lower part. The stamen, which is metamorphosed into an entry and indicator to the nectary, at this time abounding in honey, is situated in the upper part.

An insect on alighting drives its head into the aperture of the nectary to suck the honey, presses with its abdomen on the style (which increases the tension), and moving the tooth before mentioned somewhat with its proboscis, dislodges the callosity, and thus causes it to lose hold of the style. The style, henceforward free and unbridled, bursts loose with violence, strikes against the abdomen or the sternum of the insect, smears it with viscid matter, and deposits its pollen on the viscous matter; the stigmatic orifice, opportunely open, receives the pollen deposited by a like process on the insect's body from flowers visited before.

In this species of Maranta, the stigma in escaping winds itself rapidly into a flat spiral, and thus obstructs the way to the nectary, so that the flower cannot be visited more than once, and the cession of its own pollen, as well as the reception of foreign pollen, takes place at the same moment.

The apparatus of *Maranta cannæfolia* is identical, with the exception of some slight variations. The style in escaping does not form a spiral, but simply curves, and remains pressed with great force against the entrance of the nectary, henceforward preventing access to it.

Besides this difference, the flowers are more regular, in consequence of the abortion of one of the five petaloidal stamens. This abortion relates precisely to that petaloidal stamen which in the preceding species is of the least utility. In the *Maranta bicolor* the functions of signal-flag and landing-place were accomplished by two petaloidal stamens. Now an advantage is gained by these functions being accomplished by one organ alone. This, also, denotes progress in the evolution of the biological idea, being a more perfect division of labour, and numeral correspondence of the functions with the organs. Thus in the *Maranta cannæfolia* and the allied Marantæ we have one stamen with the function of signal-flag and landing-place, another with the function of door and guide to the nectary, a third with the function of pistil-retainer, and a fourth with the polleniferous function.

If a virgin flower of this Maranta is examined, the stigma will be found to project from the extremity of the inclosing and retaining staminodium with the mouth wide open ready to gather heteroclinous pollen. A short ridge of this staminodium is bent like a hook, and is attached to one of the margins of the stigmatic cavity, in order to aid the function of bridle.

In the genus Calathea, as far as one can judge from the figure which is given in the *Botanical Register*, the apparatus, particularly in the singular arching of the style, must be identical with that above described. But in the *C. flavescens* of Rio Janeiro (*Bot. Reg.* t. 932), the long and narrow floral tube would indicate its insect-fertilizers to be Lepidoptera and humming-birds; whereas, in other species, *C. grandiflora*, *C. violacea*, &c., and in the above-mentioned Maranta all the structure points to apiferous insects.

The *Phrynium coloratum*, if the figure of the style given by the table 3,010 of the *Bot. Mag.* can be trusted, must likewise possess an identical apparatus. This Phrynium appears to us a plant exactly intermediate between the genera Maranta and Thalia. The genus Thalia now alone remains to be examined, to verify whether or not the apparatus primarily discovered by Professor Hildebrand in the *Maranta Zebrina*, is common to all the Marantaceæ.

Florence, Sept. 7, 1869.

[4] Irregular flowers, for the most part, are neither erect nor pendulous; but are more or less conspicuous (*patenti*), and then they commonly conform, by the design of the entomophilous structure (that is, a structure requiring the aid of insects for fertilisation), either to the labiate or papilionaceous type. The general characters of the labiate type are the situation of the bait at the inferior part, and the anthers and styles in the superior part; thus the insect-fertilizer effects the transference of the pollen with its back. The general characters of the papilionaceous type are the situation of the bait in the superior part, and of the generative organs in the inferior part; so that the insect effects the dichogamy by means of the abdomen and sternum.

Observatory on Mount Ararat.—We learn from the *Journal of the Society of Arts* that the Russian Government have resolved to establish an astronomical and meteorological observatory on this mountain, situated near Tiflis, in consequence of the excellent report given by M. Piazzi Smyth of the fitness of such high situations, deduced from his experience in the Pic de Teneriffe.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From January 17th to 30th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Tufted Duck (Fuligula cristata)	Europe	Purchased	Three Island Pond
5 Brown Tritons (Gestriton fuscus)	Italy (near Spezia)	Ditto	Fish-house
12 Smooth Newts (Triton punctatus)	British Islands	Ditto	Ditto
2 Stock Doves (Columba œnas)	Ditto	Presented by C. L. Sutherland, Esq.	Brush Turkey's Incl.
1 Wood Pigeon (Columba palumbus)	Europe	Ditto	Ditto
1 Griffon Vulture (Gyps fulvus)	Mount Lebanon	Deposited by J. Dow, Esq.	Back of Emeu-sheds
1 Grey Ichneumon (Herpestes griseus)	India	Deposited by Capt. Jennings	Small Mammal House
1 Potto (Perodicticus potto) ♀	West Africa	Purchased	Monkey-house
1 Snowy Egret (Egretta candidissima)	Para	Ditto	Western Aviary
1 Upland Goose (Chloephaga magellanica) ♀	Falkland Islands	Received in exchange	Goose Paddocks
1 White-throated Sapajou (Cebus hypoleucus)	Central America	Deposited by Lieut.-Col. Addison	Monkey-house

♀ Female.

MOVING A HUGE BUILDING TO A NEW FOUNDATION.

THE people of Boston are very proud of the achievement of mechanical skill performed there a short time ago in the removal of the large building known as "Hotel Pelham." The event itself has already been reported, but it is so important that I have thought it of interest to readers abroad to send a brief history of the undertaking from data just made public. Some years ago the Boston city authorities, in pursuance of a plan for widening and straightening some of the streets of that city, determined to widen Tremont-street to 60 ft., which necessitated the cutting-off or removal of Hotel Pelham. Estimates were made of the damages in both cases, and it was found that removal would be the cheaper, but there were doubts of its feasibility. Experts were consulted and experiments made, and finally it was determined to move the building, an agreement being made by which the owner gave the city the right to move it back to the new line of the street, the city being responsible for the damage that might occur, and presenting the owner with a deed for the land at the rear, which the building would cover after removal. The work was to be done between May 1 and October 1, 1869. Hotel Pelham is situated at the corner of Tremont and Boylston streets, Boston; the fronts on those streets being faced with freestone backed with brickwork 12 in. to 16 in. thick, and the other walls being of brick. The building was to be moved from east to west, while it contained two brick partition walls running from north to south, and some short partitions extending from Tremont-street to the first of the former partition walls. The side of the building is not at a right angle with the front, but the east and west partitions are at right angles with the side, and therefore not parallel with the front, thus increasing the difficulties of removal. Somewhat irregular in shape, the building covers 5,800 square feet of land, having a frontage of 96 ft. on Tremont-street, which narrows to 88 ft. at the rear, and a depth of 69 ft. on Boylston-street, while the depth is 62 ft. on the other side. There were breaks on both the rear and side. The Boylston-street front was supported on eight granite columns 12 ft. high; the Tremont-street front partly on two similar columns, while the remainder was built up of rough block granite, filled in with chipstone, and so poorly constructed that it had to be tied together with iron rods and timbers. Some of the walls were cracked owing to the building having settled after its construction, and paper was pasted over these cracks to see if they increased during the removal; but no change could be discovered. The house is seven stories high above the basement; the total height above the tramways on which it was moved being 96 ft., while its weight was estimated at 5,000 tons, exclusive of the furniture and other articles that remained inside during the removal. The shops and offices on the first floor, and several suites of apartments above, were occupied at the time, the occupants being undisturbed, and the water, gas, and other pipes being kept in working order by the use of flexible tubes. The preparations for the removal began June 1, models and plans of the building having previously been made to guide the work. The basement was cleared of all the wooden partition walls and excavated to the level of the foundations. The building was to be moved westerly about 14 ft., and, accordingly, heavy block granite levellers were laid westerly from each of the walls and brick partitions for a distance of 14 ft., and similar levellers every 4 ft. between, to receive the walls running north and south as the building progressed. This made four rows of eighteen traverses each, all laid solid in cement, thoroughly rammed down to avoid danger from settling, as they bore the great weight passing over. The traverses under the front piers were 6 ft. wide (the piers being 4 ft. and 3 ft. wide) and the others 3 ft. wide; while they were sunk 3 ft. below the level of the foundations. On the top of the granite a brick wall was laid 20 in. wide in cement, excepting under the piers, where flagstones and slate were laid. On the top of this iron rails were laid, there being four on each traverse, from 3 to 3½ in. wide and ½ in. thick. They were imbedded in cement and made perfectly level, while eight rails were laid under the front piers. In addition, under the rough granite wall before mentioned, on the Tremont-street front, there were greased ways to assist its transit.

The building had to be moved in a straight line with the Boylston-street wall, and the traverses were consequently laid parallel to it. Rollers 1½ in. in diameter were laid 1 in. apart under each wall, and were placed at right angles to Boylston-street, while a square piece of hard wood was put between each two rollers to act as a guide, and to aid in replacing them when they came out behind as the building moved forward. Over the rollers were placed similar iron rails to those beneath; and over these flagstones, thoroughly wedged with slate and pointed with cement, to bear the weight of the walls above. There was great trouble and danger in getting the traverses and rollers in position under the piers, but it was successfully accomplished. To hold the lower part of the building together as compactly as possible, so that the power when applied to the exterior should operate equally on the interior walls, timbers 8 in. square were placed on each side of the walls crossing the line of motion, while over each of the traverses similar timbers were placed in the line of motion and wedged between the others. To prevent the wedging process from spreading the walls, iron rods were used to tie the walls together. These arrangements made the lower part of the building perfectly steady. The power was to be applied on the Tremont-street front, and on the exterior of the wall there a hard pine timber was set about a foot above the rollers and running the entire length of the building. This was supported partly on a brick wall and partly on a framework of timber,

both of which slipped along on greased ways. An excavation was made, and against the bank wall of the street 3-in. planks were set vertically, and in front of these another heavy timber. Between the timbers were the screws that were to move the building, each of 2 in. diameter and ½-in. pitch, there being seventy-two screws required to start the building, while the number was afterwards reduced to fifty-six, which were spread along the 96 ft. frontage on Tremont-street. There were used in preparing for the removal over 400 perches of granite, 3,000 ft. of flagging, 46,432 lb. of iron, and 49,982 ft. of timber. There were 904 rollers, and the preparations occupied two months and twenty days. Everything being in readiness on the morning of August 21, a man was stationed at every four screws, and twenty men along the lines of the various walls to watch the rollers as they came out and replace them in front, these changes having to be made every 2 in. that the building moved. At a signal from the superintendent every man at the screws made one quarter turn, which carried the hotel westward one-eighth of an inch. The average speed was an inch in five minutes, while the greatest speed was 2 in. in four minutes. The screws were 21 in. long, and it took about one hour and three-quarters to move the length of the screws, when the work had to be suspended to rearrange the screws and blocking. The first day the house was moved about 3 ft., the second day 5 ft., the third day 3 ft. 10 in., and the fourth day 2 ft., the whole distance (13 ft. 10 in.) being completed on the morning of August 25, while the actual time of moving was thirteen hours and forty minutes. After the building was in its destined place the braces and ties were cleared away, the traverses not supporting the walls taken up, and such of the rollers as were loose taken out, while such as were left were firmly cemented as part of the new foundation. The entire cost was $30,000 in currency. Larger buildings have been raised in this country, but never so large a one removed, and thousands of people watched the curious operation.—*Times.*

HOW TRAINS ARE WORKED BY TELEGRAPHIC SIGNALS IN AMERICA.

THE importance of the telegraph in connection with railways was recognized many years ago; but the first practical application of telegraphic signals in moving trains was made on the Erie line in 1850. Previous to that time, locomotive engineers and conductors were distrustful, and there are several instances on record of their positive refusal to obey telegraphic orders, especially when their trains were directed to proceed beyond stations, to meet and pass trains going in opposite directions, except in cases where such orders were plainly expressed in printed orders upon their regular time-tables. In 1850, however, when the Erie road had but a single track between Piermont and Elmira, it was plainly demonstrated to the superintendent (the late Charles Minot) that the telegraph would be a great assistance to the road, and it became plainly evident that the telegraphic service must eventually be adopted upon all main trunk-lines.

When the first telegraphic message was sent over the Erie wires a train filled with western-bound passengers was lying at Turner's Station, awaiting the arrival of an eastern-bound train, which, by the time-table, should meet and pass at that point; but, owing to an accident 200 miles west, it could not possibly arrive until five or six hours later. Mr. Minot was a passenger upon the train lying at Turner's. He immediately decided to test the accuracy of the telegraph, and make a beginning of the plan of ordering trains to proceed to points further in advance, and not further delay the stationary train when the track was known to be clear as far as Port Jervis, a distance of 150 miles further west. Orders were accordingly sent over the wire to the station agent at Port Jervis to hold all easterly-bound trains until the arrival of the western train. This order was given in order to make all safe, and prevent a collision in case the former should arrive at Port Jervis before the latter. An answer was immediately given by the station agent, announcing that he fully understood the order, and would do as directed. All appeared safe, and the engineer was ordered to start west; but, to the astonishment of Mr. Minot, he positively refused to move the train from Turner's upon any such arrangement. Mr. Minot immediately mounted the locomotive, pulled out the throttle-valve, and ran the train himself, assisted by the fireman, and reached Port Jervis according to programme.

The ice was broken, and since that time the telegraph has been acknowledged as a positive necessity on all long railroad lines in this country. The form of giving the necessary directions, however, has been somewhat changed; and now the conductors and engineers of each train who receive telegraphic directions are telegraphed the name of the particular point at which they are to meet, and answers are required from them to ascertain whether they understood orders, before any movement is made.

The following is the form of message required to be sent and received:—

"By telegraph from ——— station to conductor and engineer: You will run to ——— station regardless of train number ——. 31. ——— Despatches."

The numerical abbreviation means "How do you understand?"

The answer to this despatch must read as follows:—

"32. (I understand I am to) run to ——— station regardless of train number ——. ——— Engineer. ——— Contractor."

Upon receiving the announcement from the receiving operator that all is right, the trains are started without further orders.

All special orders for the movement of trains are required to be communicated in writing, and extraordinary precautions are taken against the possibility of misunderstanding directions. Not more than one person on a division at the same time has power to issue train-orders. The telegraph operator is required to read the messages aloud, in the hearing of the conductor and engineer addressed. Trains when in motion must approach stopping-places in the supposition that another train is there to be met. Whenever a passenger-train receives orders to meet and pass a freight-train at a specific station, the conductor must not leave the depot until notice is received from the conductor that his train is safe upon the side-track, out of the way.

No orders are given to move a slow train in the same direction, on the time, and ahead of a faster train, unless it has started—if a passenger train—at least ten minutes; and if freight, not less than twenty-five minutes in advance of the time the faster train may be reasonably expected to arrive at the station from which the slow train is first started. In cases where a slow train is moved by telegraph the following form of order is given to the conductor of said train:—

"*To* —— *Conductor and* —— *Engineer:*

You will run ahead of train No. —, to ——— station, conditioned as follows: Should you from any cause be unable to make *your running time*, you must as soon as you discover such to be the case leave your flagman to warn the following train in advance of which you are running, and report your arrival at the next telegraph station, 31."

In case of an accident where orders cannot be obtained by telegraph, the station agent has power to stop trains. The speed of live-stock and freight trains is restricted to eighteen miles an hour; and extra freight trains, commonly called "wild cats," which have no time upon the regular table, are not permitted to attain a higher rate of speed than fifteen.

Coal trains' time averages twelve miles an hour. The latter cars being very light, cannot be kept upon the track at a high rate of speed.

Many of these orders and forms originated with Col. D. C. McCullum, formerly superintendent of the Erie road, and during the late war were in general use while he was military superintendent of all the railroads in the United States. Vast armies were moved in this way in a very successful manner.

A chronometer in the principal depot is the standard time of the road, and the time is telepraphed to all stations at precisely twelve o'clock each day. Fresh engines and men are attached to all through trains at the end of each division.

The salaries of division superintendents average $5,000 a year; conductors and engineers, $100 a month; of baggage masters, $75 a month; brakemen, $1·75 a day; telegraphers, from $60 to $125 a month; station agents, from $500 to $2,000 a year.—*American Evening Post.*

FUNGI AND DISEASE.

WE believe we are correct in attributing the following very important remarks to the authorship of the Rev. M. J. Berkeley, our most eminent Britisth fungologist:—

One of the most interesting parts of the reports on the diseases of cattle in the United States, and more especially on the lung plague and periodic fever, is that which contains the account of the investigations which were made with a view to ascertain if possible whether there is any reason to believe that parasitic growths in the blood or elsewhere have anything to do with the malady. Mr. H. W. Ravenel, who has published several volumes of dried specimens illustrative of the Fungi of Carolina, undertook to examine those of Texas, while Dr. Billings and Brevet-Major Curtis applied themselves more immediately to the examination of the fluids of diseased cattle with reference to the presence of cryptogamic growths. After all that has been said as to the fungous origin of cholera,[1] and the confident assertion by Dr. Hallier that each form of fever has its own specific cryptogam, this became a necessary, and, in its general bearing, a very important object of inquiry. The examinations, which were carefully conducted, do not give the very slightest reason for supposing that there is any truth in the supposition. It may be perfectly true that minute bodies known under the name of Micrococci and Bacteria may be present even in the fluids of apparently healthy individuals, but our authors say expressly—"In a general way it may be stated that all abnormal appearances observed in the fluids examined were such as might be attributed to putrefaction. Although much remains to be learned as to the causes and nature of this process, the tendency of modern science is to class it as a species of fermentation, which may be defined as a particular mode of decomposition of organized bodies, accompanied by the growth of cells of a fungoid character, supposed to be active agents in the process."

The fungi which were generated in the fluids were the common forms which occur generally in decomposing fluids, and as regards the more minute bodies above mentioned their nature is not at present accurately known. It is true Mr. Ravenel informed us that Dr. Hallier raised from the blood and bile of diseased animals an organism which he calls *Coniothecium stilesianum*, of which he says, "Perhaps you may succeed in finding out the places where the Coniothecium grows in nature. At all events, it is a parasitic fungus growing on plants, and to be looked for in the food of the wild bullocks." This is, however, jumping to a conclusion in the same way as he did with respect to the supposed origin of cholera from a fungus derived from rice-plants; and, after all, the supposed Coniothecium may merely be a form of some of the common moulds, and may have as little to do with the genus as the much talked-of Urocystus had with respect to the *Urocystus occulta* of Rabenhorst.

We feel very thankful to Dr. Billings and his colleagues for their patient investigation, as it is highly important that attention should not be drawn off from more rational views by mere fanciful notions. The following observations are worthy of attention:—

"It seems probable, in view of the results of the above experiments, that some of the Bacteria and Micrococcus germs are really fungoid in character, and capable of development into higher forms.

"If the above-expressed view of the nature of these bodies be accepted as probable, the results of the culture experiments with fluids of disease and healthy animals can readily be understood. In many animals, whether healthy or diseased, there are no fungus germs in the blood. We have kept vacuum-tubes of blood for four months, and at the end of that time the contents were perfectly normal. In other animals there are probably germs in the blood during life, as shown by the fact that in vacuum-tubes filled from them the blood putrefied, and the usual mycoderms developed. But that these germs can develop and multiply, without dead organic material as a pabulum, is very doubtful.

"As was stated at the beginning, our object was to determine the presence, and as far as possible the nature, of these germs. The query as to the connection between them and disease, whether they should be considered as specific causes of the disease or as carriers of contagion, or as the signs of the destruction of vitality of a part of the fluid or tissues in which they are found, said destruction being due to some other cause, is one of great interest, for the answering of which, however, the lancet and injection tube will probably be far more efficacious than the microscope and 'culture apparatus.'"—*Gardeners' Chronicle.*

[1] In a letter just received from Meerut, where experiments with reference to the rice-plant had been made at our suggestion, there is the passage:—"The rice grew splendidly. I watched it daily, and throughout the whole of the time that cholera was present, and not a single fungus could I find either on living or dead leaves, or on the seed or husk."

NOTES ON THE "DOGWOOD" OF GUNPOWDER MANUFACTURERS.

BY MR. M'NAB,

Royal Botanic Gardens, Edinburgh.

IN a letter, Mr. George E. Frere, Roydon Hall, Diss, remarks—"Are you aware that the wood which is called 'Dogwood' at the gunpowder works, and used in the manufacture of the finer kinds of powder for small arms and fowling-pieces, is not *Cornus sanguinea*, but *Rhamnus frangula*, and that the main supply of it is imported into this country from Belgium and Prussia? This last-mentioned circumstance makes me think the *R. frangula* ought to be more frequently cultivated in England, for it is quite out of character that the nation should be dependent on foreigner for the supply of an important material of defence. Failing to procure plants from the English nurseries, I looked into the catalogues of the Edinburgh nurserymen, and I find the Messrs. Lawson quote it amongst ornamental trees and shrubs, at 1s. to 3s. 6d. each, while Reids, of Aberdeen, do not mention it at all. Of course there is no planting it by the acre at Lawson's price.

"If you have any means, by labelling the *Rhamnus frangula* in the Edinburgh Botanic Garden, or otherwise, of informing the public that it is the dogwood of gunpowder makers, you will be doing a national benefit thereby; and perhaps nurserymen may then turn their attention to its cultivation for coppice wood."

The notice of Mr. Frere on the use of the *Rhamnus frangula*, or alder buckthorn, as it is called, in the manufacture of the finer kinds of gunpowder, is not new, having been already

noticed by several old authors. It is, however, a most important subject, and one worthy of the attention both of nurserymen and arboriculturists. This species of Buckthorn is a tree resembling in habit some plants of the common white hawthorn. It is of easy cultivation, both in light and heavy soils, and by a little attention could soon be got in large quantities. It produces abundance of fruit, which ripens freely in favourable seasons. It could easily be cultivated in hedge-rows, or used to form hedges, as it bears cutting-in remarkably well. It could also be planted with great advantage on many railway embankments, both in England and in Scotland; with a little care after planting it would succeed well. In such places it would sustain no injury from engine-sparks.

The subject of using charcoal-producing plants for gunpowder purposes is a most important one, and one which the Highland and Arboricultural Societies should keep prominently forward for prize papers, in order that it may be fully investigated.

The genus Rhamnus now numbers about twenty-six different species and varieties, and all are probably suited for gunpowder charcoal. A few of the species are sub-tropical, some are natives of North America, others of Spain, Switzerland, and the south of Europe, while *Rhamnus frangula* and *R. catharticus*, although Continental species, are likewise considered as natives of Britain.

Dr. F. Buchanan White has recently discovered the *Rhamnus frangula* in the parish of Contin, Ross-shire, he says—"The plants (of whose number I cannot, owing to the dense growth of other bushes, speak with certainty) were in well-established bushes, about 4 ft. in height, flowering freely, and growing in a marshy ground. Its associates were all native plants—alder, willow, birch, sweet gale, common heather, &c." This circumstance shows that there is no limit in Britain to its cultivation, if parties feel inclined to grow it for profit.

It is not improbable that many other genera of shrubby plants are capable of producing a fine quality of charcoal as well as the common alder, the alder buckthorn and dogwood, all now in use. Experiments could be made on the following British woods (if they have not already been tried):—The sea buckthorn, common maple, white hawthorn, rowan-tree, bladder nut, spindle-tree, barberry, guelder rose, wayfaring-tree; also the hazel, birch, hornbeam, black sloe, furze, broom, or even the ivy, which, in many districts, is injuring our forest trees to a great extent, likewise several exotic shrubs and trees, now largely cultivated in this country.

Experiments could also be made with dried roots of many of our forest trees. After felling, such roots are generally left in the ground to rot, and are often very troublesome. If any, or all, could be turned to account for producing a useful charcoal, it would hold out an inducement to remove them from the ground, which could then be used for planting, or for agricultural purposes.

The high price which the wood and branches of the *Rhamnus frangula* bring in the British market—£10 to £14 a ton—is certainly an inducement for landholders to turn their attention to the cultivation of the alder buckthorn, dogwood, or any other trees and shrubs found best calculated for producing the finer kinds of charcoal. The dry buckthorn branches are sent from the Continent in the form of compressed faggots, and peeled previous to being charred.

Since the above was written, I have received, through the kindness of Mr. P. S. Robertson, a sample of the gunpowder-wood from the Roslin Mills, with the following letter from Messrs. Hay, Merricks, & Co.:—"We have pleasure in sending you a sample of the dogwood we use here in the manufacture of gunpowder. The sample sent is of English growth, in the county of Sussex, and the price varies from £10 to £14 per ton, according to quality. We require all peeled and packed into bundles of 100 pieces in each. The wood is cut generally in May and June."

The specimen sent from the Roslin Mills was subjected to a microscopic examination, with recent woods of buckthorn and dogwood, and turns out to be the true alder buckthorn (*Rhamnus frangula*). Besides structure, it can readily be distinguished, both in the fresh and dried state, from the dogwood (*Cornus sanguinea*) by turning yellow immediately on being moistened, which is not the case with dogwood. If dogwood is really a charcoal-producing shrub, no plant could be so easily grown, as cuttings can be got in quantity. They will soon strike root, and grow as free as a red or black currant.

The misnomer of dogwood for alder buckthorn ought to be corrected by all powder manufacturers, as it is apt to lead to unpleasant consequences, by parties growing and supplying the true dogwood, and afterwards refused by manufacturers as not being the dogwood required by them.—*The Farmer*.

ON MANGANESE AND SOME OF ITS COMPOUNDS

BY PROFESSOR CHARLES A. JOY.

In Two Parts.—Part I.

IT is difficult to trace theorigin of the word manganese. The ores containing it were variously styled female magnets, black magnesia, alabandicus, from the city of Alabanda, mangadesum by the glass makers, and later manganesium, and finally manganese. But notwithstanding the antiquity of the name, it is safe to say that even at the present time very little is known about the properties of the metal, and it is for this reason that we have chosen to speak of it, in order to put together for convenience of reference the various methods of its preparation, and the properties of the metal as accepted by the best authorities.

For a long time iron and manganese were confounded together, but after the Swedish chemist, Gahn, proved the existence of a new substance in the mineral pyrolusite, the analogy between the new metal, manganese, and the old metal, iron, at once suggested that the former could be reduced in the same way as the latter.

The oxide of manganese was heated with charcoal, and a complete reduction followed. The heat required was the same as that for the reduction of iron. The metal obtained in this way, like pig iron, was found to contain considerable silicium and carbon, and to be very brittle. Whether it could be made malleable by burning off the carbon and squeezing out the silicium in a puddling furnace has never been ascertained, as no one has ever manufactured sufficient metallic manganese to make the trial. If the first chemist who reduced an ounce of iron from the oxide by means of charcoal could see to what uses the brittle, easily rusting, unmalleable metal as described by him, is now applied, he would be slightly surprised, for in small quantities, or in the form of powder, every chemist would be forced to say that iron would have to be kept hermetically sealed, or protected by naphtha from the action of the air. It may be that manganese in larger quantities and properly refined, purified, and annealed, would be capable of being hammered into thin foil, or drawn into fine wire, but at present we have no positive knowledge on the subject.

Another method for the reduction of manganese is to fuse the chloride with an equal weight of fluor spar, and one-fifth its weight of metallic sodium. When obtained in this way it has the colour of cast-iron; is very brittle and very hard. It will take a fine polish, cannot be scratched by a file, cuts glass easily, does not change in moist air, is not attracted by a magnet, and has no effect upon the magnetic needle; it cannot be wrought, but can be cast the same as iron, and its specific gravity when prepared in this way is 7·16.

This method has been severely criticised by our best chemists, and it has been objected that the metal obtained was in no way pure, and ought not to be accepted as disclosing the true properties of manganese.

Deville fused the metal to a crystalline mass, the powder of which decomposed water rapidly; its colour very much resembled that of bismuth. The fluoride of manganese has been reduced by metallic sodium, and we have ourselves reduced the amalgam of manganese to a fine powder, but were unsuccessful in fusing it to a button.

Some authorities say that metallic manganese decomposes water at ordinary temperature; that its colour is reddish white; that it oxidizes in the air, and must therefore be kept under naphtha the same as potassium and sodium; that it is slightly magnetic, and that it readily combines with silicium and carbon, and that its specific gravity is 8.

The metal is said to be easily attacked by acids. In reference to the alloys of manganese, not so much is known as could be desired. Its effect upon iron is, however, becoming more familiar, and has been made the basis of several patents. In this country, especially, the use of franklinite iron, containing a large proportion of manganese, is well understood, and the iron produced is valuable for many purposes. In England there are thirty-six patents involving the use of manganese in iron and steel, the earliest of which was taken out in 1799.

Dr. Prieger, of Bonn, has prepared alloys of manganese and iron, and manganese and copper. An intimate mixture of black oxide of manganese, powdered charcoal, and iron filings or turnings, is made in a black-lead crucible holding thirty to fifty pounds. A covering is made of charcoal, fluor spar, and common salt, and the contents of the crucible exposed for several hours to a white heat. On breaking the crucible, the alloy of manganese and iron will be found as a perfectly homogeneous button. Two equivalents of manganese and one equivalent of iron, afford an alloy containing thirty-six per cent. of manganese; four of manganese and one of iron give about eighty per cent. of manganese. Both alloys are harder than the hardest steel; they are capable of a high polish, fuse at a red heat, do not oxidize in the air, and only partially so in water; their colour is between that of steel and silver. These alloys could be used for journal-boxes or bearings of machinery, and would be useful in affording a method for the introduction of manganese to iron or steel castings.

The alloy of manganese and copper is prepared in a similar way, and is very hard. Its properties have not been sufficiently studied by our workers in metal, and it would seem to offer a good field for investigation. It will thus be seen that our knowledge of manganese is very limited. The specimen of the metal in the cabinet at Columbia College is very hard and brittle, and has a distinctly red colour. It has been kept in a loosely stoppered bottle for several years without any signs of oxidation or absorption of moisture. It probably contains some carbon and silicium.—*Scientific American.*

Protoplasmic Masses in the Liver.—Two or three years ago Peremeschko discovered the presence of masses of protoplasm in the spleen of the embryo; and his statements are supported by the observations of Kölliker and Cohnheim on the existence of similar masses in the pulp of the spleen, even in the adult. Dr. Schenk, says the *Lancet*, having recently been engaged in investigating the history of the devlopment of the liver in the rabbit, pig, and dog, describes similar structures. They are of large size, exceeding by from two to four times the magnitude of the ordinary cellular structures of the organ. Examined in the fresh state, they are rounded, and generally, though not always, destitute of a nucleus. Placed in a one-per-cent. solution of common salt, or in iodized serum, and at a temperature of from 80° to 90° Fahr., they may be observed to protrude rounded processes, and again retract them; and these changes of form are accompanied by a certain amount of locomotion. In preparations hardened in alcohol, they are spheroidal or oval, sometimes furnished with processes. The protoplasm is granular, and provided with one or several nuclei. Dr. Schenk professes himself unable to determine whether the nuclei only make their appearance as a post-mortem result or whether they are picked up by the masses of protoplasm in their peregrinations. The expression of the latter view is indeed a reaction from the doctrine current some years since, that the nucleus was the essential part of a cell.

MR. BIGG'S APPARATUS FOR ESTIMATING THE DEFORMITY OF THE HUMAN BODY.

THE advances that have of late years been made in the recognition of the causes of deformities, and in the application of substitutes for deformed limbs, have been nearly confined to Great Britain, and we may say have almost all originated with Mr. Heather Bigg, whose artificial limbs have from time to time excited the wonder of the mechanician and the admiration of the surgeon. That our remarks are by no means an exaggeration of the facts those who take up a volume now before us[1] will soon learn for themselves. In this book, which is really one of the curiosities of modern literature, will be found an account, extending over nearly 700 pages, of what the ancients attempted in orthopædic surgery, and what the modern science of orthopraxy has achieved to alleviate some of the most distressing afflictions which befall humanity. Whether it be a lost arm or leg, a curved spine, a deformity from burn or malformation, a club-foot or a contracted hand, a fracture or a dislocation, Mr. Bigg displays equal skill in devising mechanical appliances for its treatment or replacement. And further, we may observe, that he does so not merely from a mechanical point of view, but with a thorough knowledge of the anatomy of the bones, ligaments, and muscles, and a keen appreciation of the best means of utilizing one set of muscular organs in the development of another set.

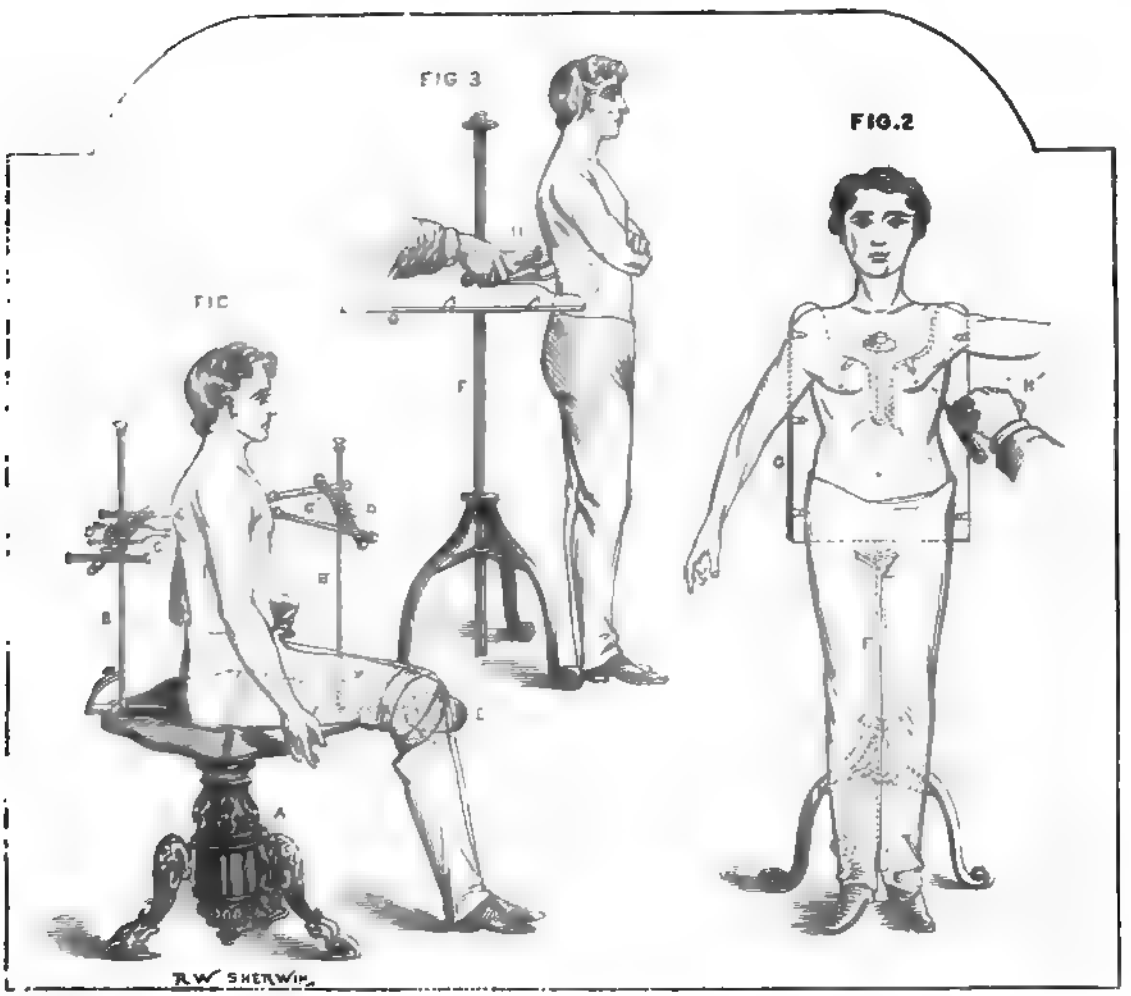
It is not, however, of these many remarkable appliances for the cure of deformity which are described in this work that we wish to treat. We desire to direct the attention of our readers to a very ingenious contrivance recently devised by Mr. Bigg, and called by him a deformity-gauge. This apparatus is well figured in the adjoining page (see p. 118), and for its description we cannot do better than quote the very clear account given in the Appendix to Mr. Bigg's interesting volume:—

It has hitherto been found impossible to arrive at a satisfactory proof of the changes which occur in a deformity of the human body at different stages of its progress. The nearest approximation to exact judgment has been gained by making a careful plaster of Paris cast of the affected region, and comparing it by measurement with subsequent models taken from time to time in the same material. It needs very little argument to show that this plan offers at the best but a very poor and inaccurate method of judgment; for if the patient varies her position the least the plaster cast becomes faulty as a means of comparison. There is also another great objection, namely, that in constructing a cast it is easy to make it possess any form most agreeable to the notion of symmetry held by the artisan who is preparing it.

Only one true remedy exists for these evident disadvantages, and that is the invention of a piece of mechanism which, when the patient is placed before it, *shall* register *of itself* with precision every curve, angle, or other irregularity presented by the surface of the human form opposed to it. To explain this more clearly, I mean that in the instance of a case of lateral or other curvature of the spine, the least deviation from the true and symmetric proportion should be at once discoverable on testing it with the deformity-gauge, of which I am assuming the possession. Governed by these impressions, I have spent a very considerable time in making experiments upon the practicability of achieving with unvarying certainty this result by means of a self-registering apparatus which, on being adjusted to well-known anatomical points, such as the angles of the scapulæ, crest of the ilium, or centre of the sternum, shall chronicle at once every deviation from normal form that the body has undergone.

After a long series of trials I have succeeded in inventing an apparatus by which the degree of deformity can be most accu-

[1] *A Manual of Orthopraxy*. By Heather Bigg, Assoc. Inst. C.E. Second Edition. Churchill, 1869.



MR. H. BIGG'S APPARATUS FOR REGISTERING THE DEFORMITY OF THE HUMAN BODY.

rately measured and its variety demonstrated. Hence, if a patient be submitted to an examination by it at regular periods, such as intervals of three months, a careful and unfailing record of every change, however minute, will be gained.

The certainty with which this can be done and the simplicity of its arrangement render the invention an invaluable aid to every one interested in the treatment of deformities; and it also enables a medical man, the patient, and her friends, to practically satisfy themselves that the case is being satisfactorily dealt with. The above drawings will explain the invention.

Fig. 1.—A represents a polished oak seat made to raise and lower like a music-stool.

B B′ are two vertical rods hinged at their base for the purpose of accommodating themselves to the position of the patient.

C C′, a system of horizontal levers made like a pantagraph, two points of which rest upon the chest, and two against the sides of the spine. These levers are graduated and engraved into inches and degrees.

D D′ are two horizontal disks, with movable hand, which register the degrees of rotation the levers may in their adjustment to the human body undergo.

E, a padded plate grasped by the knees for steadying the body when the patient is sitting.

Fig 2.—F, a metal tripod holding a frame covered with cartridge paper.

G, a frame on which the drawing of the patient's body is impressed, and which can be held either vertically or horizontally, thus admitting of the whole form of the body being accurately drawn.

H H′, two roller-pencils, which, on being moved along the surface of the body, produce a counterpart of its shape on the frame G,—one drawing the vertical lines, the other the horizontal.

To bring this plan into operation the patient is first seated upon the stool with her knees grasping E. The two points C′ rest on each side of the chest, whilst those at C are made to touch the angles of the scapula. On the disks D D′ are registered whatever amount of rotation the body presents, and the number of degrees can be read off at a glance.

The levers C C′ are so made as to expand laterally at their centre and advance or retreat horizontally, by which arrangement the most minute differences of form are noted on the sliding scales engraved upon each of them.

Having accurately obtained and read off the salient points of the distortion, the patient is then placed standing before the frame (fig. 2), when, by passing the two rollers H H′ along the surfaces of the body, an exact representation of its external form is drawn. Fig. 3 shows the apparatus applied to the

A BRAZILIAN ORCHID (*ONCIDIUM ROGERSII*).

body in the erect position, the letters referring to the same parts as in figs. 1 and 2.

The record obtained in an unerring manner by this machine is written down on printed forms expressly prepared, and at the expiration of three months another examination is made, when the instrument enables the least variation which has occurred in the mean time to be instantly discovered. In the minuteness of its detail and unfailing accuracy of its results, this apparatus may be considered a great triumph in orthopractic mechanism, as it at once removes the diagnosis of such cases from the realm of the speculative and unsound, and places it in the region of practical certainty.

I may mention, as an example of the exactness of this appliance in its practical demonstration of deformity, that upon recently placing a young lady of fifteen years of age before it who had been successfully treated for lateral curvature, and the body restored to such symmetrical proportion that the eye failed to detect any difference in shape, a slight thickening of the lumbar muscles on the left side showed on the scale to the extent of half a degree. As the highest point of curvature had originally been at the point where the thickening was recorded, the accuracy of the mechanical test was proved most completely.

A BRAZILIAN ORCHID (*ONCIDIUM ROGERSII*).

THE genus Oncidium is a very extensive one, abounding in an immense number of small as well as large-flowered species. The former, however, have not found much favour with the majority of Orchid-fanciers; neither can this be wondered at when there is such a vast number of really fine kinds which give double the amount of pleasure for the same outlay of trouble and care. Amongst the many fine forms of this genus which have been introduced to our gardens the one now under consideration certainly stands

in the front rank, a formidable rival to even the majestic *O. macranthum*.

Oncidium Rogersii is a native of Brazil, but from what part of that country I am unable to say. It was introduced by Dr. Henry Rogers, of East Grinstead, in whose stove it first bloomed. It has hitherto flowered in the autumn months; but from the fact of so few specimens existing in this country and its native habitat being unknown at present, the exact time of its flowering cannot be definitely stated. In general appearance *O. Rogersii* resembles *O. bifolium*, but upon a gigantic scale, for in the present plant the growths are as large as a pigeon's egg, and bearing upon their summits a pair of somewhat stout dark-green leaves, whilst the black markings which are so characteristic of *O. bifolium* are found also upon the pseudobulbs of this plant. The flower-spike attains a height of about 2 ft., and is much branched, bearing in the case of the specimen from which the accompanying figure was taken seventy of its brilliant flowers (one is drawn of the natural size), whilst other plants have produced spikes bearing as many as 170 blooms. The sepals and petals are very small, bearing indeed about the same proportion to the lip as do those of *O. bifolium* to the lip in that species; the lip is flat and spreading, deeply two-lobed in front, rich golden-yellow in colour, and measures from 2 to 2¼ inches in diameter.

It appears to thrive in the same temperature as *Lælia purpurata* and other similar plants, and grows admirably in a basket suspended from the roof of the orchid-house, potted in good peat and sphagnum moss, with the addition of some charcoal for drainage.

This truly grand plant is at present solely in the possession of the Messrs. Veitch, the eminent nurserymen of Chelsea.—*Journal of Horticulture.*

REVIEWS OF BOOKS.

A Manual of Qualitative Analysis. By Robert Galloway F.C.S., Professor of Applied Chemistry in the Royal College of Science for Ireland. Fifth Edition. London: John Churchill & Sons. 1870.

THIS treatise on chemical analysis, through the care of its author to make it accurate and to adapt it to the wants of the earnest student, has long been established as one of the best in our language. It was at one time a distinguishing character of this work, that in it the art of chemical analysis is taught by first giving appropriate exercises, and then helping the student to deduce from these the principles and rules of the art. In other treatises, the student was first carried through a sort of grammar, and then taught the application of this to the execution of the purposes of the art. Now, however, Professor Galloway's *Qualitative Analysis* does not possess this distinctive character, for the simple reason that in most of its fellow-treatises the same principle has been more or less fully adopted, though in none so thoroughly as in it.

In its present edition it forms a much more comprehensive work than in the previous ones. As it now stands, it includes, besides other matter, a very full descriptive account of the more important and best-known substances, in which their chemical properties are compared and contrasted in a very useful manner. And it seems to us, after an examination of its pages, that no method of learning chemistry would prove so successful as that of working out such a practical course as that laid down in it, and at the same time attending a *few* lectures on the doctrines of the science.

In addition to the account of salts and acids, together with their radicals, to be expected in such a work, descriptions, to be verified by experiment, are given of almost every "organic" substance of interest in medicine, physiology, toxicology, and the arts. The action of heat upon substances as a means of ascertaining their nature is elaborately detailed, the author availing himself of the papers of Bunsen and Merz upon the use of the Bunsen lamp as an instrument of analysis.

In the present edition Professor Galloway has adopted the modern notation and nomenclature, and, what is of more importance in a work on practical chemistry, he has added many tests to those given in the fourth edition. We consider it an omission of the author, and we have observed no other worth notice, not to have given an account of Bunsen's admirable, quick, and thorough filtering apparatus. Probably he thought it adapted for quantitative rather than for qualitative experiments; but, if so, we are hardly prepared to agree with him. Of all things most calculated to dishearten the student of qualitative analysis, the filtration and washing of slimy precipitates rank first, and therefore, to deprive them of their tedious character is to confer a very great boon on the student and to favour the cultivation of chemistry itself.

Our Domestic Fireplaces. By Frederick Edwards, Jun. A New Edition. London: Longmans. 1870.

MR. EDWARDS has now for many years been before the public as a reformer of our stoves, chimneys, and methods of ventilation, and, though we fear that his very excellent practical views have not influenced builders to the extent that they ought, we are sure that they have done a great deal in overcoming that inertia of stupidity which is not uncommon among the lower classes of architects. In the volume before us Mr. Edwards gives us an entirely re-written edition of a work which has already been very favourably received in its earlier issues. In this, he gives us first a history of the "fireplace" as far as the antiquarian lore of the subject extends, and then he describes in detail the many different varieties of grate employed, both in England and the Continent. It must not from this be imagined that the work is a mere dry catalogue. The writer shows us that he has grasped the scientific principles on which fireplaces should be constructed, and as he describes each form, he tells us of its advantages and demerits. At the end of the work are a multitude of plates containing nearly 150 well-drawn figures of stoves, grates, hot-water apparatus, and the frontispiece is an excellent lithograph of that very remarkable and philanthropic man, Benjamin Count Rumford. Thus, altogether, the work is the only complete treatise on its subject, and is one as interesting to the student of practical pneumatics, as it is important to those who are engaged either in building a new house, or in altering the stoves of an old one. We can only wish that we had known of Mr. Edwards' book a few years since, we might then have set an architect at defiance, and have economized money, heat, and coal.

Darwinianism Tested by the Science of Language. Translated from the German of Professor August Schleicher by Dr. Alex. V. W. Bikkers. London: John Camden Hotten. 1869.

IT has often been a matter of surprise to us that so few attempts have been made to test Darwin's theory by the facts of philology, as it has equally astonished us that so few critical examinations of the hypothesis of Natural Selection should have been attempted by Englishmen. It is very strange that the old idea of a Babel should be accepted by intelligent persons as the starting-point of the multitudinous tongues which now exist upon the earth; and it is not less singular that so many of the efforts to demonstrate the truth or falsity of Mr. Darwin's opinions should have come from Germany—witness the excellent monograph of Fritz Müller—*Für Darwin*—and the present admirable little essay by Professor Schleicher. The species of language must bear a distinct relation to the

varieties of the human race. If the latter are a separately-created species, then must the languages have arisen independently, and then, too, would they have little in the shape of affinity to connect them with one another. But as no scientific student of language believes that the several tongues with which philologists are familiar sprung into existence with the first flash of the lightning that demolished the Tower of Babel, so most biologists conceive that the several races of man sprang from one primitive stock, of whatsoever nature that was.

This idea is accepted by Professor Schleicher, and working upon it, he attempts to show how a careful study of the variations of language enables us to trace all tongues up to one or two parent stocks. He admits fully the force of Darwin's theory, and in fact applies it to glossology. Of course, in so small a book as the present one it would have been impossible to go into the arguments for and against the author's conclusions. Much of the book is therefore, so far, dogmatic; but it is a rational dogmatism—if we may so express it,—and to scientific men Professor Schleicher's views will almost carry with them their own demonstration. As an appendix, the author gives a genealogical table, showing the gradual evolution of various languages from one or two parent ones; and of this he gives the following brief account in his text:—

"At a remote period of the existence of the human species there was a language, a primitive language (*Ursprache*), which we can pretty clearly recognize in the so-called Indo-Germanic languages to which it has given birth. This primitive language, after having been spoken for several generations—the people who used it probably extending and increasing it meanwhile—gradually assumed a different character in different parts of its domain, until at last it branched off into a couple of languages, or possibly into more than two, of which two only survived. The same applies to all ulterior ramifications and divisions. Both these languages again, submitted repeatedly to the process of ramification. The one branch, or offshoot which, on account of its ulterior career, we will call Slavonic-Teutonic, divided in its turn through gradual reramification—Darwin's continual tendency to divergency of character—into Teutonic and Slavo-Lettic. Of these the former became the mother of all the Germanic dialects and languages, whereas the latter gave rise to the Slavonic and Lithuanian (Baltic-Lettic) tongues. The other language, which by the process of ramification had developed itself out of the Indo-Germanic primitive form, the Ario-Græco-Italo-Keltic (pardon the sesquipedalian combination), again divided into a couple of idioms, of which the one, the Græco-Italo-Keltic, became the parent of Hellenic, Albanic, and of Italo-Keltic—the latter so called because Italic and Keltic arose from it; whereas the other produced the Arian language, the closely-connected stocks of the Indic, as well as of the Iranic (Persic) class. It would be superfluous to go on with the translation of our diagram into words."

We have said enough to show the interesting and important nature of this work, for the rendering of which into excellent English we owe our best thanks to Dr. Alex. Bikkers.

Geography of India: comprising an Account of British India and the various States inclosed or adjoining. London: Wm. Allen & Co. 1869.

THE publishers intend this work for schools and students. It may be useful for the latter, especially for those who are going in for the competitive Indian Civil Service examinations; but it is not adapted to the wants of schools. It is much too condensed and too cut-and-dry for the schoolboy. It is a more suitable work for higher students, and also for reference. We need not say that the ignorance of Indian geography which is shown even by "well-educated people" is something shocking. Indeed, some people's conceptions of India remind us of a saying we once heard from a peasant in the South of Ireland, "Och, sir, England is a great town, I hear,"

How to Make Money by Patents. By CHARLES BARLOW. London; Barlow & Clare.

THE most unjust law that could possibly be framed would be an Act for the Abolition of Patents. The idea is simply monstrous, and arose in the mind of some optimist of the free-trade school whose knowledge of books is larger than his comprehension of the necessities of society. While the patent laws exist, and we feel sure that, however they may be amended, they will not be wholly repealed, inventors cannot do better than make themselves familiar with the *brochure* issued by Mr. Barlow. It contains some sound advice, the result of many years' experience, and is, we consider, an honest book. Those who do not understand the measures to be taken in establishing a patent will find all the information they require in its pages.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

Haze and Dust.—*From* Dr. Tyndall.

Sir,—I am very far from ascribing to you a "cavilling or captious spirit." On the contrary, while avoiding controversy for the present, I have to thank you for the frankness and the courtesy of your challenge regarding the "three categorical statements" which I am alleged to have made in my discourse on Dust and Disease.

The burden of the first of these statements I willingly accept—not that of the two others.

"Criticism," says one, whose memory both you and I revere, and whose words I would here apply, "is of much value; and where criticism such as yours has done its duty, then it is for other minds than that either of the author or the critic to decide upon, and acknowledge the right."[1]

Leaving the lecture to be judged and disposed of in this way, I would mention that the floating matter of the air may be either removed or redistributed by other means than heat, so as to produce visible currents in the luminous beam. With electrified bodies which precipitate the dust upon their surfaces, or with electrified points which produce minute winds among the floating particles, very curious and remarkable effects are obtained. These experiments originated with Dr. Bence Jones, who was the first to present to the beam a glass rod electrified by friction. It is very curious to see streams of darkness issuing from the electrified finger-ends. A magnet acting on the focus of the beam causes the particles to retreat equatorially, so as to form two arches right and left of the line joining the poles.

I am, Sir, your obedient servant,

Clifton Down Hotel, Jan. 30th. John Tyndall.[2]

Sir,—Your editorial article expresses some doubt as to the explanation given by Professor Tyndall of the dark, smoke-like clouds arising from heated bodies in his late experiments. The article suggests "conceivable conditions of polarization."

The writer of this had not the advantage of being present at the lecture, but the account given of the clouds has led him to speculate on the possibility of the *reflection* of the beam on passing from a denser to a rarer (because heated) medium being the cause of the observed phenomena. All rays incident on the common surface of the media beyond the critical angle would be reflected, and, consequently, would not illuminate the particles within.

It would seem unnecessary to seek any other explanation than that given by Professor Tyndall himself, except that he acknowledges a difficulty in the case in which the heat is not great enough to burn up the dust.

I am yours obediently,

Rusticus.

The Allied Universities Club.—*From* Mr. Martin.

Sir,—A paragraph appears in your journal of the 26th instant, containing certain ill-advised statements with reference to this Club, to which I beg permission to reply. I feel sure that your justice will give my letter publicity equal to that attained by the paragraph referred to.

You say that this Club, "so far as you can see," is not suited to scientific men generally. Of that I am content to allow scientific men themselves to judge. I can only say that my own experience is that, as a rule, they differ from you, inasmuch as all, or nearly all, who have made inquiries of me respecting the Club have joined it. The "vagueness" of the Prospectus is always capable of correction, as I am ready at all times, as I think you know, to supply every information that may be required. It is not the duty of the Secretary to define what is or is not a "recognized Scientific Society," but that of the Committee, who have thought it better not to make invidious distinctions, which might prove unnecessary, but rather to exercise their right of veto when ineligible applications come in. None such have yet appeared, a fact which seems to me to justify their discretion.

I cannot agree with you that the Club is in "embryo." A Club that numbers nearly a hundred members, who have joined in so short a time, may fairly be considered established. And it is the general opinion of practical men, that the "heterogeneous elements" which you condemn, will prove our great source of strength.

I am, Sir, your obedient servant,

Allied Universities Club, Grafton-st., Piccadilly, W., Jan. 29. Loftus H. Martin, *Sec.*[1]

Eunuchs among Animals.—*From the* Rev. W. Houghton, M.A., F.L.S.

Sir,—Your correspondent "E. T.," in your impression of Jan. 19, draws attention to a very curious subject of inquiry, and one which certainly requires more confirmation than it has ever yet received. Your correspondent does not inform us whether any one has ever been an eye-witness of the extraordinary custom amongst the monkeys of which he speaks. He merely states that "a civilian in India writes me that a large proportion of the monkeys which are seen in the groves round the temples are castrated," and infers that the operation is performed upon the young monkeys by the older and stronger ones. Granting the fact of many of these animals being castrated, I would suggest that it is far more probable that the emasculation is performed by some insect which deposits its eggs in the scrotum, the larvæ of which insect destroy the testicles, than that the operation is performed by the monkeys. Dr. Asa Fitch has described a dipterous insect, the Emasculating Bot-fly (*Cuterebra emasculator*), which he found to be the means of checking the increase of various squirrels of North America, in the year 1856. He then describes his first acquaintance with this insect. "August 13, 1856. Peter Reid, of Lakeville, informs me that his cat yesterday brought into the house a striped squirrel (*Sciurus striatus*). On taking it into his hands he noticed its scrotum was enormously swollen and hard, with an orifice in it about the size of a wheat-straw, and on pressing it with his fingers he could distinctly feel the writhings of something alive in this tumour. On enlarging this orifice with the point of a penknife he discovered it was a large grub, lying with its tail to the opening. . . . . It was about an inch long and half as broad, oval, and slightly depressed. . . . . He put some damp chip-dirt into a tin box, and placed it thereon. . . . . It immediately worked its head down into the dirt, and soon buried itself. Mr. Reid brings this box and squirrel to me. . . . . On examining the squirrel I find the fleshy glandular tissue of the testicles wholly consumed, nothing of them remaining but their empty outer skin. Mr. Reid says the fact is well known to hunters, that of the grey and other squirrels killed in this vicinity at least one half of the males are castrated. It is the current opinion with them that this deformity is caused by the squirrels seizing and biting at the testicles of their comrades, some of them strenuously maintaining that they have seen these animals engaged in this act. There are some hunters, however, that say they have found two grubs in the scrotum of some squirrels, and they conjecture that it is by these that the testicles are destroyed." Dr. Fitch then goes on to say that Mr. Hurst, Taxidermist of the State Cabinet of Natural History, informed him that on one occasion he saw half a dozen red squirrels (*Sciurus Hudsonius*) unite in mastering a grey one (*S. Carolinensis*), and castrating him. He had so fair and distinct a view that there could be no mistake as to the fact, his eyes witnessing the very work in which the animals were engaged. Dr. Fitch upon this makes the following query: "May it not be a flesh-fly, which drops its egg into the wound of the castrated squirrel, from which grows the grub which Mr. Reid brought me?" Nine species have been described by different authors as belonging to this genus, all of them belonging to America, except one, which occurs in India. "But what," asks Dr. Fitch, "are we to think of the statement of Mr. Hurst above retailed, and much other testimony of the same purport? The act which these persons aver that they have witnessed is so unnatural, and so much at variance with everything which has been observed elsewhere in the domain of nature, that no scientific writer, that I am aware of, has given any credit to these statements. Yet the testimony appears to be too explicit and positive to be wholly rejected; I am therefore led to believe that these animals do attack each other in the manner that has been stated, not, however, for the purpose of emasculating their comrades, as has been supposed, but for the purpose of coming at and destroying these bot-grubs, the enemies of their race. . . . . Future observations must determine whether this conjecture is correct."[2] It seems to be not unlikely, therefore, that some Indian species of the genus *Cuterebra*, or other of the family of *Œstridæ*, is the cause of the injury done to the monkeys. Does not

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[1] *Life and Letters of Faraday*, vol. ii. p. 107.

[2] We have only one comment to make on this letter—viz., that it is in every way worthy of Faraday's successor.—Ed. *S.O.*

[1] Mr. Martin finds fault with us because we desire to see the prospectus of his Club characterized by that exactness of phraseology which scientific men appreciate. He, however, makes no real reply to our objection. It is no answer that the duty of defining what is a recognized Scientific Society rests with the Committee. There should be no such vagueness in the prospectus as that we have pointed out. Candidates for membership should know whether the scientific body to which they may belong is "recognized" or not; to submit individual cases to the Committee is simply an impertinence to intending members.—Ed. *S. O.*

[2] *Third Report on the Noxious, Beneficial, and other Insects of the State of New York.* 1859.

the reported case amongst the wild asses of the Runn of Cutch require corroboration? Yours faithfully,

W. Houghton.

Sir,—In connection with the remarks of your correspondent "E. T." in the Scientific Opinion of January 19, I may mention that, when travelling in the highlands of Peru and Bolivia, my attention was, on more than one occasion, directed to castrated Llamas, which the Indian Llameros stated had been so mutilated by bites from their companions; and they also informed me that the Llamas not unfrequently revenged themselves upon one another in this manner. Whether the motive for so doing be intentional malice, or merely because in the Llama, these parts are more exposed, especially when filing off one after another, than in most other animals, I do not presume to decide.

Jan. 27. D. F.

Ordnance Datum and Heights of Tides.

Sir,—Will you kindly inform me what is the level of the datum marked on ordnance maps? Are the heights marked on tide-tables so many feet and inches above the ordnance datum figured on the ordnance maps? What is the level of Trinity high-water mark? and what is the level of the Old Dock sill at Liverpool? Your reply in "Notices to Correspondents" will oblige, Yours truly,

Jan. 27. J. B.

The Value of Negative Evidence in Geology.

Sir,—With the greatest respect for "An Old Stager's" opinion, I would venture to make a few criticisms on his letter.

I compared the British Cambrians with their foreign equivalents, and inferred from the *universal* paucity of life, that comparatively few organisms were then in being. Your correspondent seems to think I ought not to have inferred this; for he says, "The absence of fossils of a certain kind, assumed because such fossils have not yet been determined, is no proof whatever that the animals which would have left such fossils did not exist." But it is the *universal* paucity of life in these beds—when they are found in Canada, Britain, Sweden, or Bohemia—which carries such weight; and Sir C. Lyell, speaking of the absence of fish below the Ludlow rocks, says, "It seems impossible to account for our not having yet found any bones of fish, except by supposing that they were not yet in being, or that they only occupied a limited area." (*Principles of Geology*, 10th edition, vol. i. page 154.)

Professor Phillips, speaking of the paucity of life among the British and foreign lower Cambrians, says, "The absence is general; it seems due to a general cause. Is it not probable that during those very early periods the ocean and its sediments were nearly devoid of plants and animals?" (*Life on the Earth.* Cambridge, 1860.)

Sir R. Murchison (in *Siluria*), speaking of the Cambrian Annelides, says, "The fine aggregation and unaltered conditions of those (Cambrian) sediments have permitted the minutest impressions to be preserved. Surely, then, if animals of a higher organization had existed in this very ancient period, we should find their relics in this sediment." I think then I am justified in saying that, at the Cambrian era, only few plants and animals lived. "An Old Stager" says there is no dying of life as we near the older beds; but Professor Phillips remarks, "No doubt it is open to any one to compare this approach to a Hypozoic zero with the reductions of life to a minimum above the Palæozoic and above the Mesozoic deposits; and to *suppose* that below the Palæozoics *were* other earlier strata, and earlier systems of life, though they are now all lost in the general metamorphism which has produced the gneiss and mica-schist. No one is likely to believe this, however, who attends seriously to the facts regarding the successive appearance of the classes, orders, families, genera, and species, as we search the records of geological time." There may be deposits still unknown, but we cannot invalidate the testimony of the *known deposits* by vague *assumptions* of periods which, perhaps, *never existed at all*; these are witnesses which cannot be summoned into court, and it will be time to speak of such evidence when it is given, but *not till then*,—our business at present is with the known, and with the known only.

Your correspondent says that the earlier Palæozoics "appear to have been deposited under conditions in the very highest degree unfavourable to the preservation of any other vertebral remains than fishes. Even fishes' remains would rarely be found in deposits made in deep water." But many of these beds show *shores* and *shallow water deposits*, as the Caradoc and Bala beds, and the Harlech grits (Lyell's *Elements of Geology*, 6th edition, pp. 560–574), which are admirably adapted for preserving organisms. Now, this shows that littoral action went on while the Cambrians were being deposited, and when we see *the action of currents* in the present day, we cannot but suppose (bearing in mind the vast lapse of time these beds must have taken in forming) that many plants and organisms from the land would have been carried down by its rivers and swept out to sea by the currents had they really then existed. If fish then existed in the Cambrian, or lower Silurian eras, surely we should have found their remains. Your correspondent says fish would rarely be found in *deep-water* deposits; but we have seen that some of the earlier Palæozoics were deposited *in shallow water*, and fishes' bones *have* been found in profusion at the bottom of deep water in the North Sea—at a depth of no less than 235 fathoms; and what evidence is there to show that the earlier beds were deposited in a sea at all deeper than this? (See Lyell's *Principles of Geology*, vol. ii. p. 576.)

Mammalian remains might surely be found in the bed of an existing ocean if it were elevated, for they are drifted out to sea on rafts of trees and on icebergs. The bones of the Stonesfield Slate mammals were deposited in *an open sea*, doubtless brought down some river entangled in the floating vegetation, just as the mammals are now. Deep-sea dredging is as yet too imperfect for us to draw any absolute conclusions from it; only a very small part of the ocean has as yet been examined, and if (after more than fifty years' searching) the time has not come for the geological formations to speak decidedly, may we not assume that it is yet *far too early* to draw authoritative conclusions from deep-sea dredging? Few remains of a vertebrata might be found among the vegetable deposits of South America (though great numbers are known to be floated down on rafts); but then *they would be found in contemporaneous deposits*, for the luxuriant oolitic vegetation forms at some places deposits of coal, but in others its beds were deposited in a shallow sea with great quantities of vertebral remains in them; the same is the case with the Trias, and so it would be with the contemporaneous deposits at present.

I use the term "age of reptiles," because they were then *universally abundant*. They certainly existed in the Palæozoic and Cainozoic eras, but as an *inferior dynasty*, and as they attain such an extraordinary development in the Mesozoic era, I think I am justified in using it. Yours truly, A Young Beginner.

The Cause of the Periodicity of Solar-spots.—*From* Mr. A. Elvins, *of Toronto.*

Sir,—Will you permit me to lay before your readers the reasons which led me to the conclusion *that the* 11½ *solar-spot period owes its existence to the November meteor system?*

It is a well-established fact, that the frequency and extent of black spots on the sun is subject to a periodical change; it is also known that the interval from one minimum to the next minimum is variable, but that its average value, deduced from observations of more than a century, is about 11½ years.

This period has been usually attributed to planetary influence, and Jupiter has been thought to be the disturbing body; but I am obliged to reject this as the true cause for the following reasons:—

1. There is a discrepancy in the length of time in which Jupiter completes a revolution, and the average solar-spot period, amounting to about 280 days.

2. If this were the cause, as Jupiter's period is not far from regular the solar-spot period must be of equal length. But the solar periods are known to vary greatly, and we are thus driven to seek the disturbing cause somewhere else.

And here I must state two facts in reference to myself. First, I was satisfied, for reasons stated in my *Theory of Comets*, that comets must undergo a process of division and ultimate dispersion, and that fragments of cometary matter thus thrown off, when cooled down and condensed by the cold of interplanetary space form meteoric clusters, or rings, in the orbit or path of the comet; and, second, I had an impression that solar spots were caused by meteors falling into the sun.

Your readers will now understand me when I state the process of reasoning which led me to the conclusion that the November meteor system is the cause of the 11½ year period of solar disturbance.

I reasoned thus: If meteors are condensed cometary matter, moving in the path of former comets, or of comets still in existence, they will be more likely to drop into the sun about the time of their perihelion passage than at other times; the fact that the innermost planets of the solar system are more closely grouped together than the more distant ones, would lead us to expect that their disturbing influence on the course of the meteoric masses might lead to the precipitation of those masses into the great centre of attraction, the sun; and the fact that the chances of meteors coming into contact with other meteors moving in an opposite direction, and thus destroying the momentum of both, would be much greater when the meteors were near their perihelion than at other times.

Now I said: If meteors are the real cause of solar disturbance, one large group, nearly filling an entire orbit, more dense at a little distance from the preceding part of the group than at other parts, and thinning out at each end, but having a break or space in the orbit in which there were no meteors, and this group revolving in the space of 11½ years, would meet the requirements of the case. But

I soon saw that such a group would require the solar-spot period to be regular, and as this is nothing like the fact, like Jupiter, it had to be given up.

But if a comet has divided as Biela's did, and has formed a number of meteoric groups, they will revolve nearly in the same orbit, and come to their perihelion at irregular intervals; but as all must pass through their perihelion in the space in which one group makes a revolution, the sum of the different intervals, divided by the number of groups, must give as an average 11⅛ years, if they can possibly be the cause of the solar-spot period.

The following must also accord with the facts. If different groups, revolving in the same orbit, are really the cause of sun-spot periods the different groups *must follow each other in the same order* during each revolution.

Further, the meteoric groups must be subject to planetary perturbations, in the same manner as comets are; and will reach their perihelion sometimes sooner, sometimes later, than the average time.

I now looked for a comet with a period which would admit of meteoric groups revolving in its orbit, to fulfil those conditions; and from the fact that Halley's comet has a period of about seven times the solar-spot period, I had hope that I had found the cause here. But I soon found the discrepancy in time to be beyond my ability to explain, and this further objection showed itself, viz.; the long and short periods would shift the order of occurrence, the long period sometimes commencing the cycle and the shortest at others. I was thus forced to give up Halley's comet.

About this time, fortunately, Professor Loomis issued a chart of solar-spot periods, to illustrate an article on Aurora, and I noticed (what, possibly, I might never have noticed from figures only, which do not strike the eye) that the cycle was not composed of *seven* periods, but *three*; and that the order of succession was nearly as follows,—9, 13, 11 years: those periods exhausted, the cycle commenced again. It now became evident that I had to find a comet of 33¼ years, three times the average of the sun period, to meet the requirements of the case.

Like a flash of lightning Temple's little comet and our beautiful November meteors rushed into my mind; and though I trembled to apply the tests, I could not but hope that the cause of the periodicity had been found. I took Professor Loomis' chart and examined it in the following manner: Temple's comet passed its perihelion in 1866, and was followed by the meteoric group, which has not yet passed us; the chart showed that in 1866 the minimum of sun-spots was then in existence. The sun was almost spotless. This was what might be looked for, if my views, as expressed in my letters on comets, are correct, that the comet comes to its perihelion before the meteors, which are formed from the portions which are continually being detached from it, and which has been proved to be the fact in the case of Temple's comet and the November meteors. I now look back over the chart to see how it was with former perihelion passages, for if this spotless period exists because the foremost part of the group of meteors is near its perihelion, then a similar state of solar spotlessness must exist at each 33¼ years previous. So in 1832 we should have had a minimum, and such was the fact. In 1799, a minimum should have taken place; so it did. Again, in 1776 we should have had a minimum; so we had: backward to another 33¼ period the chart did not extend, and so I could follow it no farther.

This much then is clear. When Temple's comet has passed its perihelion during the last 100 years, the solar spots have been at their minimum.

Now, between any two perihelion passages of Temple's comet and the corresponding solar minimum, we find two other minimum periods; the last occurring in 1855.

Now, if the sun-spot periods owe their existence to three large meteoric clusters revolving in nearly the same orbit, the minimums occurring when the intervals between those clusters are passing perihelion; then, as we had a minimum in 1855, we should have had a minimum 33¼ years previous, when the same group was approaching perihelion in the year 1822: the facts show this to have been so. 33¼ previous we should have had another, in 1788; we *had not*, the minimum occurred near four years earlier. This discrepancy is one of the strong points of our theory, as we shall show farther on. 33¼ previous to 1788 we should find another minimum, and in 1755 it did occur.

There remains one other period in the cycle always occurring about 12¾ years earlier than the one we have been just tracing. Its last occurrence took place in 1842, and its next will be in 1875. We need not follow them; it is a fact that they have occurred at periods 33¼ years apart during the last 100 years. So far as we have gone, I found that three groups, in an orbit of 33¼ years, would meet the requirements of the case. In the 33¼ year cycle they are at irregular intervals of time (9¼, 12¾, 11); but from any one of those to the corresponding one in the previous cycle is a period of 33¼ years; they also succeed each other in the proper order—9¼ is followed by 12¾, and this by 11. But we have found one marked discrepancy, and I asked, Will this fulfil the remaining condition? has it been produced by or is it a planetary perturbation? Here Mr. Proctor's admirable delineation of the orbit of the November meteors, in the *Student*, vol. ii. p. 256, came to my aid; and a table in a paper on Sun-spots, by Professor Norton, which you gave us in SCIENTIFIC OPINION during its previous existence, on May 2, 1866, gave me the mean heliocentric longitudes of Jupiter and Saturn. I found that in 1779 the preceding part of the group which should have reached its perihelion in 1788, had passed its aphelion about 7 years, and was now some distance inside the orbit of Uranus. At this time Saturn's heliocentric longitude was 232° in a position in which its attraction on any incoming body moving in the November orbit would be the greatest possible. For years previous to this it had been in a position to accelerate such meteors if they existed, and for years afterwards its action would produce smaller results. But this was not all; Jupiter was on the same side of the sun, and its powerful action would join with that of Saturn to accelerate the coming group. It seems to me impossible for those planets to have been more favourably situated to accelerate the coming bodies, and thus to shorten this period of solar spots; and, notwithstanding the commensurability of those planets' periods, they have not been so favourably situated since. I have followed the other periods with equally satisfactory results.

But I must draw to a close; I am intruding too much on your space, and your readers will be weary following me; and yet I seem to have but begun my subject. I would have sent the investigations themselves, but they would have required several large engravings, which would have rendered them inadmissible in your paper. I hope they will be published at some future time. But I shall have to ask still more space for a letter on the maxima. I have thought this plain statement of facts the best way to reply to Mr. Proctor's letter. Your readers will see that what I claim as a discovery is not "vague guesswork," jumped at in a moment's notice, without labour. It is part of the result of years of patient but pleasurable toil, carried on under difficulties of which Mr. Proctor can form no idea. But I have no word to say against him; if I could use sarcastic irony, I would not do it. I owe Mr Proctor for many excellent papers in the *Student* and *Popular Science Review*. Those I will remember, and his letter I will try to forget. I am, Sir, truly yours,

ANDREW ELVINS.

P.S.—What I claim to have discovered is the cause of the periodicity of solar spots; but if I have really done this, I have done more: I have discovered the existence of two swarms of meteors in the November orbit previously unknown.

Toronto, Jan. 6. A. E.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, JANUARY 20TH.—The following papers were unavoidably crushed out of our last week's notice:—"On the Mechanical Performance of Logical Inference," by W. Stanley Jevons, M.A. Lond., Professor of Logic, &c., in Owen's College; communicated by Professor E. Roscoe, F.R.S.—It is remarkable that from the earliest times mechanical assistance has been employed in mathematical computation. The use of pebbles, of the fingers, and of the *abacus* of the Greeks and Romans may be adduced as examples. Mathematicians have constantly delighted in devising mechanical modes of calculations, as in the case of Napier's bones, mechanical globes, slide rules, &c. Actual machines for performing difficult calculations have been designed or constructed at various times since the early part of the 17th century, by Pascal, Morland, Leibnitz, Gersten, or Babbage.

In logic, on the contrary, we meet with a total absence of any actual mechanism, although logical works abound with expressions implying the need of such aid. The name of Aristotle's logical treatise, the "Organon," or *Instrument*, and many definitions of logic, clearly express this idea, which is also distinctly stated by Bacon in the second aphorism of his "New Organon,"

This inability of logicians to realize their notions of a mechanical logic in a material form, analogous to the many kinds of calculating machines, can only be explained by the extreme incompleteness o their doctrines. It is the advance of logical science, chiefly due to the late Dr. Boole, Professor De Morgan, and George Bentham, which now enables us to produce a truly mechanical logic.

Boole, in his celebrated work on the *Laws of Thought* first put forth the problem of logical science in its complete generality:—*Given certain logical premises or conditions, to determine th edescription of any class of objects under those conditions.* The ancient forms of logical deductions are but a few isolated cases of this general problem, which Boole solved in a complete but exceedingly obscure manner. In my *Pure Logic* (London, Stanford, 1864) and my *Substitution of Similars*

(London, Macmillan, 1869) I have endeavoured to show that the mysterious mathematical form of Boole's logical system is altogether superfluous, and that in one point of great importance he was deeply mistaken. His logical views, when simplified and corrected, give us a method of indirect deduction of extreme generality and power, founded directly upon this most fundamental law of thought. A proof of the truthfulness and power of this system is to be found in the fact that it can be embodied in a machine just as the calculus of differences is embodied in Mr. Babbage's calculating machine.

To explain the nature of the logical machine alluded to, it may be pointed out that the third of the fundamental laws of thought allows us to affirm of any object one or the other of two contradictory attributes, and that we are thus enabled to develop a series of alternatives which must contain the description of a given class or object. Thus, if we are considering the propositions—

Iron is metal,
Metal is element,

we can at once affirm of iron tha tit is included among the four alternatives:—

Metal, element,
Metal, not element.
Not-metal, element.
Not metal, not element.

But according to the second law of thought, nothing can combine contradictory attributes, and this law prevents us from supposing that *iron* can be *not metal* while the first premise affirms that it is *metal*. The second premise again prevents our supposing that the combination *metal, not element* can exist. Hence the only combination of properties which the premises allow us to affirm of *iron* is *mstal, element*. In a similar manner a complete solution of any logical problem may be effected by forming the complete list of combination, in which the terms of the problem can manifest themselves, and then striking out such of the combinations as cannot exist in consistency with the conditions of the problem.

The logical machine actually constructed represents the combination, 16 in number, of four positive terms, denoted by A, B, C, D, and their corresponding negatives, *a*, *b*, *c*, *d*. The instrument is provided with eight keys, representing these terms when appearing in the subject of a proposition, with eight keys, placed to the right hand of the former, representing the terms when occurring in the predicate of a proposition, and with certain *operation* keys denoting the *copula* of the proposition, the *full stop* at the end of it, and the conjunction *or*, according as it occurs in the subject or predicate. There is also a key denoting the *finis* or end of an argument, which has the effect of obliterating any previous impressions, and making the machine a *tabula rasa*. If now each of the letter terms A, B, C, D be taken to represent some logical term or noun, and propositions concerning them be, as it were, played upon the machine, as upon a telegraphic instrument, the machine effects thereby such a classification and selection of certain rods representing the 16 possible combinations of the terms, that only those combinations consistent with the propositions remain indicated by the machine at the end of the operations. When once a series of propositions is thus impressed upon the machine, it is capable of exhibiting an answer to any question which may be put to it concerning the possible combinations which form any class.

The machine thus embodies almost all the powers of Boole's logical system up to problems involving four distinct terms, and to represent problems of any complexity involving any number of terms only requires the multiplication of the parts of the machine. The construction involves no mechanical difficulties, and depends upon a peculiar arrangement of pins and levers, which it would not be easy to explain without drawings. In this arrangement of the parts the conditions of correct thinking are observed; the representative rods are just as numerous as the laws of thought require, and no rod represents inconsistent attributes. The representative rods are classified, selected, or rejected by the reading of a proposition in a manner exactly answering to that in which a reasoning mind should treat its ideas, and at every step in the progress of a problem the machine indicates the proper condition of a mind exempt from mistake.

It is believed that this logical machine may be usefully employed in the logical class-room to exhibit the complete analysis of any argument or logical problem; and it is superior for this purpose to a more rudimentary contrivance, the logical abacus, constructed by me for the same purpose, and previously described. But by far the chief importance of the machine is in a theoretical point of view as demonstrating in the simplest and most evident manner the character and powers of a universal system of logical deduction, of which the first, although obscure solution, was given by Dr. Boole.

"On Jacobi's Theorem respecting the relative Equilibrium of a Revolving Ellipsoid of Fluid; and on Ivory's Discussion of the Theorem," by I. Todhunter, M.A., F.R.S., late Fellow of St. John's College, Cambridge.—Jacobi discovered the theorem that a fluid ellipsoid revolving with uniform angular velocity round its least axis might be in equilibrium. Ivory discussed the theorem, and made several statements regarding the limitations of the proportions of the axis. Ivory's statements contain various errors, and truths based on erroneous reasoning. The object of the present memoir is to correct Ivory's errors, to supply his imperfections, and to add something to what is already known respecting the theorem.

January 27th.—The following papers were read:—"Remarks on the recent Eclipse of the Sun as observed in the United States," by J. N. Lockyer, F.R.S.—By the kindness of Professors Wenlock, Morton, and Newton, I have been favoured with photographs, and as yet unpublished accounts, of the results of the recent total eclipse of the sun observed in America. I am anxious, therefore, to take the opportunity afforded by the subject being under discussion, to lay a few remarks thus early before the Royal Society.

The points which I hoped might be more especially elucidated by this eclipse were as follows:—

1. It is possible to differentiate between the atmosphere and the corona?
2. What is the real photographic evidence of the structure of the base of the chromosphere in reference to Mr. W. De La Rue's enlarged photographs of the eclipse of 1860?
3. What is the amount of the obliterating effect of the illumination of our atmosphere on the spectrum of the chromosphere?
4. Is there any cooler hydrogen above the prominences?
5. Can the spectroscope settle the nature of the corona during eclipses?

With regard to one, the evidence is conclusive. The chromosphere, including a "radiance," as it has been termed by Dr. Gould (the edge of the radiance as photographed being strangely like the edge of the chromosphere in places viewed with the open slit), is not to be confounded with the corona.

On this subject, in a letter to Professor Morton, Dr. B. A. Gould writes:—"An examination of the beautiful photographs made at Burlington and Ottumwa by the sections of your party in charge of Professors Mayer and Haines, and a comparison of them with my sketches of the corona, have led me to the conviction that the radiance around the moon in the pictures made during totality is not the corona at all, but is actually the image of what Lockyer has called the chromosphere.

"This interesting fact is indicated by many different considerations. The directions of maximum radiance do not coincide with those of the great beams of the corona; they remain constant, while the latter were variable. There is a diameter approximately corresponding to the solar axis, near the extremities of which the radiance upon the photographs is a minimum, whereas the coronal beams in these directions were especially marked during a great part of the total obscuration. The coronal beams stood in apparent relation to the protuberances, whereas the aureole seen upon the photographs is most marked in their immediate vicinity; indeed the great protuberances, at 230° to 245°, seems to have formed a southern limit to the radiance on the western side, while a sharp northern limit is seen on all the photographs at about 350°, the intermediate arc being thickly studded with protuberances which the moon displayed at the close of totality. The exquisite masses of flocculent light on the following limbs are upon the two sides of that curious prominence at 93°, which at first resembled an ear of corn, as you have said, but which, in the later pictures after it had been more occulted, and its southern branch thus rendered more conspicuous, was like a pair of antelope's horns, to which some observers compare it. Whatever of this aureole is shown upon the photographs was occulted or displayed by the lunar motion, precisely as the protuberances were. The variations in the form of the corona, on the other hand, did not seem to be dependent in any degree upon the moon's motion. The singular and elegant structural indication in the special aggregations of light on the eastern side may be of high value in guiding to a further knowledge of the chromosphere. They are manifest in all the photographs by your parties which I have seen, but are especially marked in those of shortest exposure, such as the first one at Ottumwa. In some of the later views they may be detected on the other side of the sun, though less distinct; but the very irregular and jagged outline of the chromosphere, as described by Janssen and Lockyer, is exhibited in perfection."

The second point is also referred to in the same letter. I think the American photographs afford evidence that certain appearances in parts of Mr. De La Rue's photographs, which represent the chromosphere as billowy on its under side, are really due to some action either of the moon's surface or of a possible rare lunar atmosphere, so that it is not desirable to confound these effects with others that might be due to a possible suspension of the chromosphere in a transparent atmosphere, if only a *section* of the chromosphere were photographed.

Dr. Gould writes:—"You will observe that some of the brighter, petal-like flocculi of light have produced apparent indentations in the moon's limb at their base, like those at the bases of the protuberances. These indentations are evidently due to specular reflection from the moon's surface, as I stated to the American Association at

Salem last month. Had any doubt existed in my mind previously, it would have been removed by an inspection of the photographs."

Where the chromosphere is so uniform a light that the actinic effect on the plate is pretty nearly equal, the base of the chromosphere is absolutely continuous in the American photographs: but in the case of some of the larger prominences, notably those at + 146 (Young) and — 130 (Young), there are strong apparent indents on the moon's limb.

I next come to the obliterating effect of the illumination of our atmosphere on the spectrum of the chromosphere.

This is considerable; in fact the evidences of it are very much stronger than one could have wished, but hardly more decided than I had anticipated. Professor Wenlock's evidence on this point, in a letter to myself, is as follows:—"I examined the principal protuberance before, during, and after totality. I saw three lines (C, near D and F) before and after totality, and eleven during totality; *eight were instantly extinguished on the first appearance of sunlight.*"

This effect was observed with two flint prisms and 7 in. aperture. Professor Young, with five prisms of 45° and 4 in. aperture, found the same result in the part of the spectrum he was examining at the end of the totality.

He writes:—"I had just completed the measurements of 2602, when the totality ended. *This line disappeared instantly*, but 2796 [the hydrogen line near G] was nearly a minute in resuming its usual faintness." These observations I consider among the most important ones made during the eclipse; for they show most unmistakably that, as I have already reported to the Secretary of the Government-Grant Committee, the new method to be employed under the best conditions must be used with large apertures and large dispersion.

On the 4th point the evidence is but negative only, and therefore in favour of the view I have some time ago communicated to the Royal Society.

We next come to the question of the corona,—a question which has been made more difficult than ever (in appearance only I think) by the American observations.

I propose to discuss only the spectroscopic observations of Professors Young and Pickering in connection with Dr. Gould's before quoted remarks.

Professor Pickering, with an ordinary chemical spectroscope merely directed to the sun's place during totality, obtained the combined spectrum of the protuberances and corona. He saw a continuous spectrum with two or three bright lines, one "near E," and a second "near C."

Professor Young, who used a spectroscope specially adapted for the work, in which only one part of the prominence at + 146° was being examined, saw C, near D, a line at 1250 + 20, and another at 1350 + 20 of Kirchhoff's scale. The rest of the observations I give in his own words.

Then came the 1474 K line, which was very bright, though by no means equal to C and D_3; but attention was immediately arrested by the fact that, unlike them, it extended clean across the spectrum; and on moving the slit away from the protuberances, it persisted, while D_3, visibly in the edge of the field, disappeared. Thus it was evident that[1] this line belonged not to the spectrum of the protuberance, but to that of the corona. My impression, but I do not feel at all sure of it, is that the two faint lines between it and D_3, behaved in the same manner, and are also corona lines.[2]

I am confirmed in this opinion by Professor Pickering's observation. He used a single-prism spectroscope, with the slit of the collimator simply directed to the sun, and having no lens in front of it. With this arrangement he saw only three or four bright lines, the brightest near E (1474). Now this is exactly what ought to occur if that line really belongs to the corona, which, from its great extent, furnished to his instrument a far greater quantity of light than the prominences.

[1] On two or three occasions previously I had been very much surprised at not being able to detect this line in the spectrum of unusually bright prominences. On the other hand, I once found it very easy to see at a place on the sun's limbs where the other chromosphere lines, usually far more brilliant, were almost invisible.

[2] A careful examination of the photographs, especially No. 2 of the Burlington totality pictures, somewhat diminishes my confidence in the conclusion of the text as to the nature of these three lines (1250, 1350, and 1474). They certainly do not belong to the spectrum of the most brilliant portion of the prominences; but around the prominences of the eastern limbs, on which the slit of the spectroscope was directed during the first half of the totality, the protograph shows a pretty extensive and well-defined nebulosity, evidently distinct from, though associated with, the brilliant nuclei. Now it is possible that these lines may belong to this nebulosity, and not to the corona proper; for I cannot recall with certainty whether 1474 retained its brilliance at any considerable distance from the prominences, or only in their immediate neighbourhood. My strong impression, however, is that the former was the case, and that the text is correct. I may as well confess my uncertain memory here is due to the fact that just at this time, while my assistant was handing me the lantern with which to read the micrometer-head, I looked over my shoulder for an instant, and beheld the most beautiful and impressive spectacle upon which my eyes have ever rested. It could not have been for five seconds; but the effect was so overwhelming as to drive away all certain recollection of what I had just seen. What I have recorded I recall from my notes taken down by my assistant.

By this time the moon had advanced so far that it became necessary to shift the slit to the great prominence on the opposite side of the sun. While my assistant was doing this, I suppose I must, in the excitement of the moment, have run my eyepiece over the region of the magnesium lines (*b*), and thrown them out of the field before he had brought anything upon the slit. At any rate I saw nothing of these lines, which were evident enough to several other observers, and can think of no other way to account for their having escaped me. The F line in the spectrum of the great protuberance was absolutely glorious, broad at the base and tapering upwards, crookedly as Lockyer has before often observed. Next appeared a new line, about as bright as 1474 at 2602—2 of Kirchhoff's scale. Its position was carefully determined by micrometrical reference to the next line, 2796 K (hydrogen γ), which was very bright; h was also seen, very clear, but hardly brilliant. In all I saw nine bright lines.

A faint continuous spectrum, without any traces of dark lines in it, was also visible, evidently due to the corona. Its light, tested by a tourmaline applied next to the eye, proved to be very strongly polarized in a plane, passing through the centre of the sun. I am not sure, however, but that this polarization, as suggested by Prof. Pickering, may have been produced by the successive refractions through the prisms. This explanation at once removes the difficulty otherwise arising from the absence of dark lines.

I have first to do with the continuous spectrum, deduced from Professor Pickering's observations.

I think in such a method of observation, even if the corona were terrestrial and gave a dark-line spectrum, the lines visible with such a dim light would in great part be obliterated by the corresponding bright lines given out by the long arc of chromosphere visible, to say nothing of the prominences, in which it would be strange if C, D, E, *b*, F, and many other lines, were not reversed. This suggestion, I think, is strengthened by the statement that two bright lines were seen "near C" and "near E"; should we not rather read (for the "near" shows that we are only dealing with approximations) C and F: which is exactly what we might expect.

But even this is not all that may be hazarded on the subject of the continuous spectrum, which was also seen by Professor Young under different conditions.

Assuming the corona to be an atmospheric effect merely, as I have before asserted it to be, it seems to me that its spectrum should be continuous, or nearly so; for is it not as much due to the light of the prominences as to the light of the photosphere, which it may be said roughly are complementary to each other?

With regard to the Aurora theory, I gather from Professor Young's note that, if not already withdrawn, he is anxious to wait till the next eclipse for further facts. I consider that the fact that I often see the line at 1474, and often do not, is fatal to it, as it should be constantly visible, on the proposed hypothesis. The observation of iron-vapour, as I hold it to be at this elevation, is of extreme value, coupled with its simple spectrum, *seen during an eclipse*, as it entirely confirms my observations made at a lower level in the case, not only of iron but of magnesium.

"On the Theory of Continuous Beams," by John Mortimer Heppel, Mem. Inst. C.E.; communicated by W. J. Macquorn Rankine, F.R.S.—The chief object of the present communication is to remedy some acknowledged defects in the theory of the above-mentioned subject. The principal steps by which it has reached its present state of development are also noticed, and may be briefly recapitulated as follows:—

In 1825 M. Navier investigated the conditions of straight continuous beams resting on any number of supports. His method, though perfectly correct for the assumed conditions (which embraced most cases occurring in practice), was so exceedingly intricate when the number of openings became at all large, that in such instances it was of little practical use.

In 1849 M. Clapeyron, a distinguished engineer and savant, devised a much more direct and easy means of treating such cases, though he did not at first succeed in giving to his own method all the simplicity and elegance of which it was capable.

This was first done in 1856 by M. Bertot, civil engineer, who, by effecting an elimination which had escaped Clapeyron, arrived at a remarkable equation, which has been the key to all subsequent treatment of the subject. This equation involves the bending moments over any three consecutive points of support, and is well known in France by the name of the "Theorem of the Three Moments."

In 1857 M. Clapeyron himself and M. Brefne, Professeur de Mécanique appliquée à l'Ecole Impériale des Ponts et Chaussées, appear to have discovered this theorem independently of M. Bertot, and M. Brefne shortly afterwards extended it to a much greater degree of generality.

M. Brefne's researches on this subject are published in the third volume of his *Cours de Mécanique appliquée*, Paris, 1865; but they had been communicated by him to the Academy of Sciences in 1862, and fully completed in the previous year. M. Brefne not only contributed to the advancement of the theory, but entered largely into the

best methods of its application to practice, and framed rules which have since, under an Imperial Commission, acquired the character of legislative enactments.

M. Bélanger, Professeur de Mécanique appliquée à l'Ecole Centrale, appears about the same time as M. Brefne to have made an independent investigation of this subject, and to have brought the theory of it to about the same stage of advancement.

Little has been since added to this theory in France, but valuable contributions to its development in reference to practice are to be found in various works.

In England Professor Moseley is the first writer on mechanics who appears to have occupied himself with this subject. In his work on *The Mechanical Principles of Engineering and Architecture*, he gives several examples of the application of M. Navier's method to important practical cases. This work was published in 1843, and no doubt furnished the groundwork for Mr. Pole's more extended investigations.

In 1852 Mr. Pole had to examine the case of the bridge over the Trent at Turkney, involving some new conditions not treated by Moseley, but which he found the means of treating with perfect success. About the same time Mr. Pole had to deal with the much more complex and important case of the Britannia bridge, in which, besides variation of load from one span to another, variation of section also had to be considered, and imperfect continuity over the middle pier. These conditions were successfully imported into this method of Navier, which was, however, only known to Mr. Pole through the examples of its application given in Moseley's work, and the results obtained were identical with those which would have followed from the application of the method of Clapeyron in its most improved and generalized form.

In 1858, the present writer, being then in India, had occasion to consider the condition of a continuous girder of five spans, and finding the method of Navier unmanageable, was forced to seek for some other. He first came upon the equation which he afterwards found had been for some years known in France as the "Theorem of the three Moments," and afterwards extended it, so as to take in all the conditions of the Britannia bridge and to verify all Mr. Pole's results. In this form it was absolutely identical with the equation given by M. Bélanger, and nearly so with that of M. Brefne.

The great defect in all this theory up to the present time has been that, in order to avoid an inextricable complexity, it has been necessary to consider the load in each span as uniformly distributed over it, and the moment of inertia of the section as uniform throughout each span.

In many cases these hypotheses are false, notably so in the case of the Britannia; and the conclusions are affected by their falsity, to what extent being a matter of uncertainty, though good grounds have been shown for believing that the errors cannot attain to importance.

The method now given treats these conditions, it is hoped, rigorously; and although the equations obtained are such as necessarily require some laborious computation to obtain numerical results, they are certainly by no means inextricable.

It is satisfactory to find that in the case of the Britannia, where these new conditions enter with much greater force than in most cases, their effect on the resulting stresses is very unimportant; so that the inference may legitimately be drawn that in all ordinary cases the method of Brefne may be confidently applied. As regards the deflection, they seem to exercise a more perceptible influence, in the case of the Britannia bringing it much nearer to the observed deflection.

It would therefore appear desirable in any important work to use the equations now given for determining the deflections, though the stresses may be found with all sufficient exactitude from the simpler expressions already in use.

It is scarcely possible in a short abstract to give an idea of an analytical investigation. The equations obtained are of the same form as those of the previous methods, each containing, as unknown quantities, the bending moments over three consecutive supports; but the coefficients are somewhat involved functions of the varying loads and sections. An abbreviated functional notation has, wherever possible, been used, by means of which a certain degree of clearness and symmetry is preserved in expressions which would otherwise become inextricably complex.

"Remarks on Mr. Heppel's Theory of Continuous Beams," by W. J. Macquorn Rankine, C.E., LL.D., F.R.S.

The author states that the advantages possessed by Mr. Heppel's method will probably cause it to be used both in practice and in scientific study.

With a view to the instruction of students in engineering science, he proposes an abridged way of stating the theoretical principles of Mr. Heppel's method, considering at the same time that Mr. Heppel's more detailed investigation forms the best model for numerical calculation.

He then uses Mr. Heppel's improved form of the "Theorem of the three moments" to test the accuracy of the formulæ which he obtained in another way and published in *A Manual of Civil Engineering*, for the case of a uniform continuous beam with an indefinite number of equal spans, the successive spans being loaded alternately with an uniform fixed load only, and with a uniform travelling load in addition to the fixed load; and he finds the results of the two methods to agree in every respect.

LINNEAN SOCIETY.

JANUARY 20TH.—George Bentham, Esq., president, in the chair. Col. R. Benson, Messrs. N. L. Austen, F. P. Balkwill, J. Goucher, G. Harrison, C. A. Robinson, E. Taylor, and A. Woodward were elected fellows. The following papers were read:—"A Revision of the Flora of Iceland," by C. C. Babington, M.A.; "Contributions to British Muscology," by S. C. Lindberg, M.A., communicated by Dr. J. D. Hooker; and "On New British Spiders," by the Rev. C. P. Cambridge, communicated by J. Salter, Esq.

CHEMICAL SOCIETY.

JANUARY 20TH.—Dr. A. W. Williamson, F.R.S., &c., president, in the chair. The following gentlemen were elected fellows:—I. Bell, A. Bird, G. R. Hislop, E. Lapper, H. Seward. The first paper read was "Note on the Absorption of Mixed Vapours by Charcoal," by John Hunter, M.A., Queen's College, Belfast. The author, some time ago, published, in the *Journal of the Chemical Society* (May, 1868), the results obtained by absorbing the mixture of two vapours by means of cocoa-nut charcoal. He found that the absorption was increased when one of the vapours was at a temperature near to its point of condensation; and he explained the phenomenon by assuming that, when a fragment of charcoal is introduced into a mixture of two vapours, the one which is nearest to its point of condensation is first absorbed, and this, in its condensed state in the pores of the charcoal, aids the absorption of the other vapour. According to this view, a succession of condensations is going on. The theory is strikingly illustrated in experimenting with a mixture of water vapour and ammonia gas (obtained by heating an aqueous solution of ammonia of sp. gr. 0·88), when the mixture is much more largely absorbed than either the gas or the vapour separately. The mean of a set of experiments made at 100° and a mean pressure of 706·2 m.m. was—316·6 vols. of the mixture absorbed by 1 vol. of charcoal.

The president remarked that the results were entirely in accordance with what was expected on theoretical grounds.

The next communication was—"The Composition of Iron-Rust," by Dr. Crace Calvert. The author had lately occasion to analyse rust obtained from two different places,—from the outside of the Conway Bridge, and from Llangollen, North Wales; and he found both specimens to be composed as follows:—

Sesquioxide of iron	92·900
Protoxide of iron	6·177
Carbonate of iron	0·617
Carbonate of lime	0·295
Silica	0·121
Ammonia	traces
	100·000

This result induced the author to inquire to which of the constituents of the atmosphere the formation of rust is chiefly due. To this end, clean blades of steel and iron were put into tubes filled respectively with oxygen, oxygen and a little carbonic acid, oxygen and moisture, &c. The blades were introduced into the tubes, which then were filled, over mercury, with oxygen. But this proved an unsatisfactory method, inasmuch as always some globules of mercury remained adhering to the iron, whereby a galvanic action was produced, which, of course, induced a rapid oxidation. To avoid this, the tubes were filled simply by displacement of the atmospheric air. The blades were then left exposed to the action of the different agents for a period of four months. The results were as follows:—

Blades in dry oxygen.—No oxidation.

Blades in moist oxygen.—Out of three experiments, only in one a slight oxidation.

Blades in dry carbonic acid.—No oxidation.

Blades in moist carbonic acid.—Slight incrustation of a white colour. Out of six experiments, two did not give this result.

Blades in dry carbonic acid and oxygen.—No oxidation.

Blades in moist carbonic acid and oxygen.—Most rapid oxidation.

Blades in dry oxygen and ammonia.—No oxidation.

Blades in moist oxygen and ammonia.—No oxidation.

These facts led the author to assume that it is the presence of carbonic acid in the atmosphere, and not oxygen or water vapour, which determines the oxidation of iron.

The author next investigated the behaviour of iron in water into which, successively, oxygen, carbonic acid, a mixture of the two gases, &c., was conducted. The results were analogous to those above men-

tioned, inasmuch as the most effective oxidation took place when a mixture of oxygen and carbonic acid was introduced into the water. The action commenced immediately, and, in a short time, a dark precipitate covered the bottom of the vessel. The oxidation, in these cases, was not due to the fixation of the oxygen dissolved in the water, but to oxygen liberated from the water by galvanic action; the occurrence of hydrogen collected above the liquid in the bottles proved this sufficiently. A further evidence for the supposition that the oxidation of the iron is effected through the decomposition of the water is found in the fact that, when into distilled water which had previously been deprived of all its absorbed gases by continued boiling a bright blade is introduced, it became, in the course of a few days, here and there covered with rust. The spots where the oxidation had taken place proved to be impurities in the iron, which had induced a galvanic action, just as a mere trace of zinc, placed on one end of the blade, would establish a voltaic current.

Finally, Dr. Calvert investigated the state of iron in alkalies; and he discovered that, not only the solutions of the caustic alkalies, but of their carbonates as well, protect iron against any oxidising action.[1]

ETHNOLOGICAL SOCIETY.

TUESDAY, JANUARY 25TH.—Professor Huxley, president, in the chair. The following new members were announced at this and the preceding meeting. The Earl of Dunraven and Mountearl, K.P., Lord Rosehill, J. W. Barnes, Esq., T. H. Baylis, Esq., D. Duncan, Esq., M.A., J. Edwards, Esq., J. F. McLennan, Esq., W. Morrison, Esq., M.P., and R. L. Nash, Esq.—Dr. Hooker, C.B., exhibited a collection of figures in unbaked clay, modelled by a native Zulu; and Col. Lane Fox exhibited some stone mullers used for pounding grain. Mr. Bonwick, F.R.G.S., read a paper "On the Origin of the Tasmanians, geologically considered."—The Tasmanians have now become almost extinct, an old woman being the only survivor of the race. They were related in manners and in general *physique* to the neighbouring Australians, but were allied by black skin and woolly hair to the distant Africans, while they were assimilated by resemblance of language, customs, and habits of thought, to many races scattered over vast areas. The author sought to explain this relation by constructing an ideal southern continent, whence all the dark-coloured races surrounding the Indian Ocean, and extending into the Pacific and southern oceans may have radiated. He regards the Tasmanian as probably older than the Australian. Dr. Hooker, whose authority had frequently been quoted in the paper, pointed out the similarity and differences that obtain between the floras of Australia, Tasmania, New Zealand, South Africa, &c. It has recently been found that the flora of the Howe Islands is very unlike that of Australia, although so near to the coast. He protested, however, against the inference that the line of migration followed by plants is necessarily the same as that pursued by the higher animals. The president alluded to the great difference between the Australian and Tasmanian, especially in the character of the hair; and he regarded it as physically impossible that the Tasmanian could have come from Australia. He suggested that an interrupted communication by a chain of islands may have extended from New Caledonia to Tasmania, similar to that which now connects New Caledonia with New Guinea; and that by this means a low negrito type may have spread eastward over this area.

Mr. Howorth's paper, "On a Frontier-line of Ethnology and Geology," was then read. Siberia and North America form a well-defined province, botanically, zoologically, and ethnologically. North of the isothermal line forming the southern boundary of this province dwell the Ugrian races, whose conditions of existence were compared by the author with those of the prehistoric period. In Europe, the isothermals have been gradually twisted to the north by the Gulf Stream, and the author believes that the gradual advent of the Stream may be traced from no earlier period than about the twelfth century B.C. Remarks on this paper were made by the president, Dr. Hyde Clarke, Dr. Richard King, and Col. Lane Fox. Mr. Atkinson read a "Note on the Nicobar Islands," and exhibited some grotesque figures carved in wood, taken from the Nicobars by Capt. Edge, in 1867, and recently brought to this country by Capt. Mackenzie. These figures are to be placed in the Christy collection, and similar objects have been forwarded to the Museum in Edinburgh.

ROYAL GEOGRAPHICAL SOCIETY.

THE fifth meeting of the present session of this society was held on Monday the 24th ult., at the Royal Institution; Sir R. I. Murchison, president, in the chair. The first communication received was a letter from the society's envoy, Mr. G. W. Hayward, who has recently accomplished a successful journey to Yarkand and Kashgar, and is now preparing for an exploration of the Pamir table-land lying between Eastern and Western Turkestan. The letter was dated from Srinagar, the capital of Kashmir, November 17th, 1869. The traveller had had several interviews with the Maharajah and his Ministers regarding his project of entering the unknown region beyond their frontier by the Gilgit valley, and they had represented to him the difficulties and risks he would have to encounter among the hostile tribes at the head of the valley, where the protection of the Maharajah would be of no avail. Recently the Kashmirees on the frontier had caught a party of robbers of the Hunza tribe, whom they mutilated and killed, and reprisals were expected; and as Mr. Hayward's route lay through the Hunza territory this had greatly increased his difficulties. He expressed, however, his determination to make the attempt. The president announced that as Mr. Hayward would probably push forward by the sources of the Oxus and Zariafshan into the new Russian province of Turkestan, he had written to the president of the Imperial Geographical Society to request the favour of his intercession with the Ruasian Government to secure a welcome reception for the traveller, and that he had received a most favourable reply. All that could now be done was to hope for the success of Mr. Hayward's dangerous journey over those lofty passes and plateaus that lie between British India and the Russian possessions.

A paper was then read by Mr. J. L. Palmer, R.N., on a recent visit to Easter Island in H.M.S. *Topaz*. During the visit the singular colossal stone images which excited the astonishment of Captain Cook and the earlier voyagers were accurately observed and measured, and a specimen of them brought away to deposit in the British Museum. Mr. Palmer described the topography of this remote island in the South Pacific. It is only 12 miles in length by four in width, and lies in a part of the ocean far away from other islands, at a distance of 2,000 miles from the coast of South America, and 1,000 miles from the nearest Polynesian Islands to the west. The island is entirely a volcanic formation, and presents numerous extinct craters, one of which yields the grey lava of which all the stone images are made, and another the red tufa from which are carved the crowns or hats that formerly rested on their heads. The present inhabitants are only 900 in number—a good-looking, pleasant-tempered, set of people. They belong to the Polynesian race, and have a tradition of their immigrating from Opara at no very distant period. The interest attaching to the island was an ethnological one, and concerned the race who sculptured the vast quantity of stone images now existing *in situ* on stone platforms in various parts of the island, or inside large stone chambers or houses. The platforms, chambers, sculptures, and mural paintings were described by the author with minuteness, but he did not propound any theory as to their origin. He stated that the inhabitants knew nothing of the matter, that they were undoubtedly of great antiquity, and that it was probable they were executed by a race who had long since passed away.

In the discussion which followed, Mr. Markham mentioned the fact of similar images having been found by the early Spanish invaders in the cities on the banks of Lake Titicaca, in South Peru, and belonging to the Aymara nation. There existed, however, this difference—that the Aymara images were profusely sculptured. Recently a stone platform had been found in one of the Pacific Islands, 1,000 miles to the west of Easter Island, at the bottom of a deep deposit of guano, and he threw out the suggestion that these were all relics of a very ancient people who slowly migrated across the Pacific from west to east. Mr. Franks gave in detail his reasons for concluding that the ancient remains in Easter Island truly belonged to an earlier population of the same Polynesian race who now inhabit the island. Sir George Grey also expressed the same opinion, and spoke of the habit of carving images as being a peculiarity of Polynesians, including the Maories, and that in a place where wood (the usual material) was very scarce, as it is in Easter Island, it was natural that stone should be substituted. Mr. Palmer gave some further details of the amiability and good conduct of the present inhabitants, who had been much improved by the Roman Catholic missionaries. Mr. P. P. Blyth also took part in the discussion, and the president, in summing up, mentioned the soft nature of the volcanic rock of which the images were made as supporting Sir George Grey's explanation.

The following new fellows were elected:—Messrs. R. G. Clements, G. Dallas, R. Davonport; Colonel H. L. Evans (late Bombay Army); Messrs. E. M. Hopkins, T. S. Johnston, F. Lassetter, Alexander Lawrence, A. Laing, G. F. Mare, J. A. Man, (Commissioner of Customs for Formosa), Neville F. Mackay, W. J. G. Napier (Master of Napier); Surgeon J. L. Palmer, R.N., Major E. B. Sladen (Political Agent at the court of his Majesty the King of Burmah), and Mr. E. Silva.

ENTOMOLOGICAL SOCIETY OF LONDON.

ANNUAL MEETING, JANUARY 24TH.—Frederick Smith, Esq., vice-president, in the chair. The Report of the Council for 1869 was read by the secretary.

The following gentlemen were elected members of the council for 1870, namely, Messrs. H. W. Bates, Dallas, Dunning, Fry, Grut,

[1] From the *Chemical News*.

McLachlan, Parry, Pascoe, E. Saunders, S. Stevens, A. R. Wallace, and Wormald.

The following officers for 1870 were afterwards elected:—President, Mr. Alfred R. Wallace; Treasurer, Mr. S. Stevens; Secretaries, Messrs. Dunning and McLachlan; Librarian, Mr. E. W. Janson.

An address by the retiring president was read; and thanks were voted to the officers and members of the council for 1869.

THE INSTITUTION OF CIVIL ENGINEERS.

At the last meeting a copy of the correspondence between the Indian Government and the Institution was laid before the members. It is an explanation of the difficulty which already existed.

NUMISMATIC SOCIETY.

January 20th.—W. S. W. Vaux, Esq., president, in the chair. The council exhibited a selection of coins and medals from the society's collection. Mr. Vaux made a few remarks, in the course of which he gave a short sketch of the history of the formation of the collection.

Mr. Corkran exhibited a gold quinarius of the Emperor Geta, reading on the obverse P. SEPTIMIVS GETA CAES, and having the head of Geta to the right. On the reverse is the legend NOBILITAS, and a female figure to the left, leaning upon a sceptre and holding the palladium. This quinarius is interesting as being a hitherto unpublished specimen.

Mr. Evans read a paper communicated by Mr. Neck, "On some Silver Coins of Edward IV. and V."

Mr. Arnold communicated a paper "On some Coins of Cnossus, bearing the word πόλχος," in which he considered the question as to whether it is the name of a magistrate or a contraction of πολιοῦχος.

EDINBURGH BOTANICAL SOCIETY.

The society met at Edinburgh on Thursday, 13th January, Robert Brown, Esq., V.P., in the chair. Donations to the Museum, Library, and Herbarium were laid on the table. Prof. Balfour referred to the death of Miss Jane Farquharson, a lady-associate of the society. Her father was Thomas Farquharson, of Howden, in West Lothian, a retired surgeon of the E.I.C.S., and her mother was Elizabeth Macleod, daughter of Donald Macleod, of Geanies, in Ross-shire, and sheriff of that county. She was born at Howden on 18th February, 1802, and died on 24th December last. She lived with her parents at Howden, and afterwards at Charlesfield, in the same neighbourhood; then at Inveresk, till her father's death, about 1830, since which she resided in Edinburgh. She was kind and generous, and had a love for everything good and beautiful. She was an earnest Christian, and a warm and generous member of the Free Church of Scotland. She was elected a lady-associate of the Society on 12th May, 1842. The following communications were read:—

"Notes on the Embryo of *Ruscus aculeatus*," by Professor Dickson.—Dr. Dickson made some remarks on the embryo of this plant, which he had examined from fruits sent to the Botanic Garden by Mr. Frere, of Roydon Hall, Norfolk. The embryos were remarkable for their great variability in size, general form, and more particularly in the orifice of the cotyledon. Regarding the last point, the majority of the specimens exhibited the lips of the cotyledonary orifice as approximated, thus forming a "slit," this being evidently the normal arrangement, and corresponding to the ordinary type of cotyledonary orifice in Monocotyledons. In some cases the lips of the orifice were seen to gape in a remarkable manner. In these embryos the plumule is almost always small, rudimentary, and pretty deeply sunk in the cavity of the cotyledon; but in one case, Dr. Dickson observed it to be very much enlarged, completely filling up the cotyledonary cavity, and appearing externally between the lips of the cotyledon. Dr. Dickson's observations were illustrated by specimens under the microscope, and by drawings.

"Notice of Plants collected in Spitzbergen and Nova Zembla in the Summer of 1869," by William Livesay, Esq.

"Notice of some Botanical Excursions with Pupils during the Summer of 1869," by Professor Balfour.

"On the Botany of the Dominion of Canada and adjacent parts of British America (Part I., Ranunculaceæ)," by Professor Lawson, Dalhousie College, Halifax, Nova Scotia.

"On the Introduction of Ipecacuanha Plant (*Cephaelis Ipecacuanha*)," by Mr. M'Nab.

"Notice of *Sicana odorifera*, Naudin (*Cucurbitur odorifera*), Velloso, Flor. Flum.," by Senhor Joaquim Correa de Mello, Camprinas, Province of St. Paulo, Brazil; communicated by Daniel Hanbury, Esq.

"Hints for collecting Cryptogamia," by Professor Dickie.

Miscellaneous Communications:—

"Flowering of Eranthis and Leucojum."—A note was read from Dr. W. R. M'Nab, in which he said:—"I send a diagram showing the dates of flowering of *Eranthis hyemalis* and *Leucojum vernum*, in the Royal Botanic Garden, Edinburgh, for twenty years. In 1850 they flowered within four days of each other, in 1851 within five days—but one month earlier than 1850; in 1852 Eranthis was fifteen days later, while Leucojum was one month; in 1853 Eranthis was one day behind 1852, while Leucojum was one month (21st February to 21st March); in 1854 Eranthis was a few days earlier, while Leucojum was more than a month earlier; in 1855 both very late, but within a day of each other; 1861, 1862, 1863, and 1864, are peculiar; in 1863 Leucojum flowered before Eranthis, while in 1864 Eranthis was in flower on 1st January, much earlier than in 1863, Leucojum being three days later; the other times they flowered pretty closely. The differences in the year 1860 are much less than in 1850." Mr. M'Nab in making some remarks on Dr. M'Nab's communication, stated, that owing to the frost being still on the ground, none of the spring flowers were at this date in bloom.

Ruscus aculeatus.—Mr. M'Nab stated that Mr. Frere, Roydon Hall, Diss, had recently sent to the Botanic Garden a plant of the *Ruscus aculeatus* in flower and fruit. In a letter accompanying the plant, Mr. Frere remarks:—Sowerby said of Ruscus, in 1799, "the root is perennial, the plant itself is biennial, and for one winter evergreen." And Bentham writes:—"Stems said to be biennial, though apparently shrubby." It is possible that the flowers one year may be female; the next year male. On the question of sex, I find Linnæus (*Genera Plantarum*) writes:—"Species datur floribus hermaphroditis," &c. And Irvine, *Introduction to Botany*, London, Nelson & Son, 1858, pp. 307, 308, gives as generic character:—"Flowers lateral, monœcious or dicœcious;" and as specific character, "Flowers dicœcious by abortion." Professor Balfour remarked that he and Mr. Sadler had lately examined the flowers of Ruscus very carefully, and had found male and female flowers on the same plant, and male flowers alone on other plants.

"Cones of Abies."—Mr. William Gorrie exhibited and presented branches and cones of (1) *Abies rubra*, taken from a group of trees growing on the railway banks, near Tynehead Station, in Midlothian, at an altitude of about 800 feet. The trees have been about fifteen years planted, and are from 12 to 18 feet high. (2) *A. rubra*, from a group of trees growing in drained and improved ground, which must have once been marshy, in Dunmore Park, near Stirling, not 50 ft. above high-water mark, seemingly about the same age as the last, and from 15 ft. to 20 ft. in height. (3) *A. alba*, from near Tynehead Station. (4) *A. nigra*, from Dunmore Park. Mr. Gorrie remarked that *A. rubra*, the red spruce fir, or Newfoundland red pine, is found in Nova Scotia, some parts of Lower Canada, and northward to Hudson's Bay, but is not included in Dr. Asa Gray's flora of the northern United States. It is said to be a taller and finer timber tree than either of its allies—the black and white American spruces, from which it further differs in being entirely devoid of that glaucous green by which the leaves of these two are distinguished. It is, in fact, exactly like the common Norway spruce in the colour both of its foliage and young branches, but differs from it in its thinner and more slender growth, shorter leaves and much smaller cones. From this close resemblance in colour of the *A. rubra* and *A. excelsa*, Americans call the latter the red spruce of Europe. Like the *A. alba*, the *A. rubra* drops its cones in the course of the first winter and succeeding spring, while those of *A. nigra* are retained on the tree for two or more years. Like its two American associates, *A. alba* and *A. nigra*, *A. rubra* seems to delight in moist soils, containing a proportion of peat, and moist upland climates. Those now growing at Tynehead were reared from seeds gathered in Newfoundland, and a portion of the plants which were planted on good, dry, heavy soil, within from two to three miles, and at half the altitude, dwindled away after the first few years, till they entirely perished. The trees at Dunmore are no doubt growing at a low altitude, but they are sheltered by a high wooded bank on the south, and are on a damp bottom. Mr. Andrew Murray, a distinguished member of the Botanical Society, and recognized authority on Coniferæ, has ignored the existence of *Abies rubra*, but he has probably never seen it growing as although long introduced, it is still scarce in Britain.

Presentations.—The Rev. A. Williamson exhibited and presented numerous specimens of fruits, seeds, &c., brought home by him from China. Messrs. J. & J. Cunningham presented cocoa-nuts, which had sprouted during the voyage to this country. Mr. George H. H. Dewolf presented a collection of dried plants from Nova Scotia. Mr. Mawson presented specimens of *Asplenium alternifolium*, and *A. septentrionale*, collected by him in August last, in Cumberland. Mr. Archibald Jerdon presented a specimen of *Bupleurum aristatum*, which had been found by Mr. Borthwick growing in a field near Melrose.

ROYAL HISTORICAL AND ARCHÆOLOGICAL ASSOCIATION OF IRELAND.

This Association, formerly the Kilkenny Archæological Society, held its annual meeting, the first under the addition to its title of "The

Kyan," recently conferred by her Majesty the Queen, at Butler House, Kilkenny, on Wednesday, Jan. 5th, Captain the Right Hon. W. F. Tighe, lieutenant of the county, in the chair. The Rev. J. Graves, jun., read the Report of the Committee for the year 1869, and read the correspondence with Mr. Bruce, through which the Queen has signified her assent to the adoption of the expression "Kyan," in the title of the society.

The chairman and members present expressed much gratification at the honour done by her Majesty to the society, and the report of the committee was unanimously adopted. A change in the association's general rules, consequent on its new constitution, under the Queen's letter, being necessary, the five first, the ninth, and twelfth rules were brought up to be altered.

The following resolution was suggested by the hon. secretary, and passed unanimously — Resolved—That the Annual Report be printed, and that we hereby express the deep sense of our gratitude to her Majesty the Queen for the favour she has so graciously conferred on this association."

A large number of books and pamphlets, the greater portion being the publications of learned societies, sent for presentation to the library, were laid before the meeting. Amongst them was a copy of Mac Firbis' splendid illustrations of the Celtic ornamentation copied from the ancient MSS. in Trinity College.

Dr. Aquilla W. Foot, Dublin, contributed an able and highly interesting paper "On the Cave of Dunmore," which he had a short time since explored, in company with the Rev. J. Graves, and Mr. Burtchaell, C.E., for the purpose of investigating the human remains found in the cavern. Having detailed the arrangements of Mr. Burtchaell, in organizing a party of diggers for the purpose, and quoted some descriptions of the place given by old and more recent writers who had visited it, Dr. Foot referred as follows to the formation of the cave, the derivation of the name, and a remarkable historical event connected with it:—

The cave itself is formed beneath and in beds of carboniferous limestone, which above are interstratified with beds of dolomite. Rain water filtering through these strata becomes supersaturated with salts of lime, and as it trickles from the roof forms stalactites of every size and length from miniature pendants to broad based columns uniting roof and floor, also encrusting the floor with stalagmitic deposits of varying thickness. The modern name of Dunmore, the Great Fort, is derived from some fortification which existed at or near the cave, *dun* being the generic term for the different kinds of Irish strongholds. Its older name is Deare Fearna, *i. e.* the cave of alders; this name is still in local use; *dearc* or *derc* (dark), signifies a cave or grotto, also the eye; it is probable that the latter is the primary meaning, and that its application to a cave was figurative and secondary. The alder-tree is called in Irish *fearn* (*farri*), but in the present spoken language the diminutive *fearnog* (*farnoge*) is always used, the syllables *farn* and *fern* which are found in names in every part of Ireland, denote the prevalence of the alder-tree; thus, there are several places called Ferriage, Fernagh and Ferney, denoting a place producing alders. Ferns in Wexford is well known in ecclesiastical and other records by the name of Fearna, *i. e.*, alders, or a place abounding in alders. Glenferrie, a valley near Manorhamilton, is called by the Four Masters, Glannfearna, the alder glen. In an ancient manuscript in the library of Trinity College, Dublin, called Irish Triads, in which are enumerated three of each of the most remarkable objects in Erin, as the three highest mountains, the three highest cataracts, the three broadest plains, and the three largest rivers, it is stated that the three darkest Caves in Ireland are Uaimh Cruachan, *i. e.*, the Cave of Croghan. Uaimh Slaine, *i. e.*, the Cave or Crypt of Slaine; and Dearc Fearna, which is understood to mean the Cave of Dunmore, County of Kilkenny. The larger and equally dark Cave near Mitchelstown, on the road joining that place and Cahir, is a modern discovery, the principal cavern having been accidently tapped in quarrying, 2nd May, 1833. In the *Annals of the Kingdom of Ireland by the Four Masters* it is mentioned that "In the age of Christ, 928, Godfrey, grandson of Imbar, with the foreigners (Danes) of Athcliath (Dublin), demolished and plundered Dearc-Fearna, where one thousand persons were killed, in this year, as is stated in this quatrain:—

"Nine hundred years without sorrow, twenty-eight, it has been found,
Since Christ came to our relief, to the plunder of Dearc Ferna."

In the inmost recesses of Dearc Ferna unmistakable evidence remains of the truth of the statement that a wholesale murder was perpetrated there, in the osseous remains of men, women, and children, which though not now strewing the cave in the same profusion as they formerly did, may be procured in quantities by disturbing the surface of the floor in a particular place. Having described the more remarkable features of the various branches of the cave, and pointed out that the human remains are only found in the western branch, and within a kind of natural rampart which would form an impregnable fortress to any body of men defending it, until starved or smothered by the besieging party in their fortress, Dr. Foot went on to state the result of the delving of his party, thus:—The sandy soil about the pool, at the end of this branch of the cave, was turned up with spade and crowbar, and was a mass of human bones, mixed with a dark damp compost of sand, clay, and carbonate of lime. Many portions of every part of the skeleton were taken up, but no entire cranium was brought to light or discovered; these parts of the skeleton have from time to time been removed as curiosities, or as mementoes of a visit to the place. There is abundant evidence from the accounts of former visitors before quoted that they have been seen there, but they have now disappeared, at least from the surface. Their incrustation with carbonate of lime by adding such grotesque ornament to those naturally interesting relics, would insure their removal, and such has been observed to have happened in other similarly circumstanced caverns. Other parts of the skeleton less attractive to ordinary visitors, enabled us to ascertain beyond question that the bones of large numbers of men, women, and children lay in this part of the cave. In no other part were any human remains found. As our guides, so called, had been at the entrance to the cave clearly instructed that no human bones but those of pagans would be found in the cave, they had no hesitation in disturbing the soil about the pool, loudly denouncing any people who would frequent such a place as "worse nor haythens"—probably regarding these bones as those of veritable cave-men, who, having been cannibals of the worst description, may fairly be classed with the least enlightened of the human race.

The soil of this part of the cave yielded, on analysis made since this visit, 17 per cent. of organic matter, whereas the usual quantity of organic matter, taken from a locality where the soil is but little impregnated with vegetable remains in average clay, not manured, is from five to seven per cent.; showing that a large proportion of the soil near the pool may be looked on as consisting of human mould. The soil analyzed was a portion of a lump taken up at hazard from outside the pool: there was no large bone in it, but many small fragments through it; indeed it would have been impossible to take up any of the flooring of the cave which did not contain abundance of bones in various stages of dissolution. The ground seems to have been often disturbed here before, and this would account for the great quantity of small fragments and the completely comminuted state of many of the bones, as the rooting and trampling of a number of persons smashes up the brittle old bones like so many egg-shells. Appended to these observations is a list of 113 human bones, or fragments of bones, which I have been able to identify. On each bone is a number corresponding to a similar number in the catalogue referring to the name of the bone, or part of the bone. An abstract of this list gives the following result:—Bones of skull, whole or fragments, 12; face, 6; vertebræ, 21; ribs, 8; upper extremity (clavicle, scapula, humerus, radius, ulna), 29; bones of hands, 4; lower extremity (pelvis, femur, patella, tibia, fibula), 14; feet, 19: total, 113. The only bones of the face found, were those of the upper and lower jaws—one of the former and five of the latter; the other facial bones are not calculated, from their structure, to last very long, or to survive much rough treatment. The bones found are singularly exempt from the marks of disease; the teeth found, twenty-two in number, were all sound and perfect; it is in accordance with usual observation that the soundest and most healthy bones *cæteris paribus* resist decay much better than do unhealthy or defective ones, and therefore when a quantity of bones long dead are examined, it is not surprising that all found after a long lapse of years, should appear to have suffered only from the effect of time. Only one bone presented any appearance of rheumatic alteration.

Among the 113 bones named and numbered, there is conclusive evidence of five different skeletons, and that these persons belonged to different age and sex. Nine bones were found of persons under twenty years of age; five heel-bones (os calcis) of the left foot; five distinct portions of different arm-bones (humerus) of the left side; five portions of the lower jaw of different individuals of various ages. There are characteristic portions of four left shoulder-blades (scapula), and four knee-caps (patella) of individuals, differing in age and sex. The bones removed from the cave were not selected, but rapidly picked out of the soil as turned up with the spade, and put into a sack with as little clay adhering to them as possible; and it was not until a considerable time afterwards that I had leisure to examine the bones and fragments which had been obtained. If we consider the quantity of bones which still remain in the cave, or the immense quantity which time must have destroyed, along with the fact that evidence of the skeletons of five persons were quickly picked up, I think that we have very strong confirmation of the veracity of the old historical record, that a number of people met with death in the cave. The mode of death of those persons is open to conjecture. They may have been kept shut in and starved, or they may have been smothered by the smoke of fires lighted at the entrance—the latter is a mode of dealing with an enemy of which there is more than one instance in civilized as well as barbarous warfare. It has been remarked by Mr. Robert Mallet, formerly president of the Royal Geographical Society of Ireland, that in stalagmites from this cave, layers of finely divided charcoal are sometimes met associated with the calcareous matter. These layers have been found in microscopic examinations by Dr. Allman to

be the charcoal of coniferous wood; possibly, he observes, the remains of ancient fires. In *Tighe's Survey* it is stated that in or near this cave some clay coloured with carbon and called black chalk, has been taken up. It is quite possible that, the charcoal above alluded to represented the remains of some occasional fire lighted for the purpose of illumination or cookery; it is not likely that any persons ever chose this cave for a dwelling-place for any length of time, as from its dampness and the irregularities of the floor it seems badly adapted for a habitation, though obviously suited for a place of temporary security.

After a scientific consideration of the evidence as to probability of the great antiquity of the human remains, warranting the conclusion of their being the remains of the unfortunate natives killed there by the Danes of Dublin in the tenth century, Dr. Foot concluded his paper by expressing a hope that persons who had hitherto removed any human bones from the cave, and still possessed them, would deposit them in the association's museum, to be employed for the purpose of the elucidation of Irish history.

A conversation on the interest attaching to the result of Dr. Foot's investigation of the cave, ensued, in which Dr. James, Dr. Lalor, Dr. Fitzsimons, the Rev. J. Darby, and the Rev. Dr. Martin, took part.

Mr. Robertson objected to the derivation of the ancient name of the cavern from the alder. There were plenty of elder-trees, but no alder-trees found growing at the mouth, and the alder was only suited to marshy places, such as the locality of Dunmore was not.

The Rev. James Graves agreed with Mr. Robertson that, whatever might formerly have been the fact, the mouth of the cave of Dunmore was not such a place as suited the growth of alder at present. But he could bear personal testimony as to the inhabitants of the district knowing the cavern by the Irish name of *Dearc Fearna*—the latter word, however, in the local pronunciation of Irish, taking somewhat the form of "*Yorna.*"

The other papers were chiefly historical. An adjournment to the first Wednesday in April then took place.

ARMAGH NATURAL HISTORY SOCIETY.

The usual meeting was held on Wednesday week. After the admission of members, Dr. Riggs introduced the subject of the landrail and haddock to the notice of the meeting, and an interesting discussion ensued. Mr. Mills then sketched a number of diatoms, and detailed their history with great clearness, and a most instructive conversation followed. Mr. Faris, C.E., of the Observatory, is to lecture this month before the society on "The Sun."

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

Paris, January 24th.—The Academy proceeded to elect a correspondent in the section of physics in the place of the late Professor Forbes. The Secret Committee gave the following return of the names of candidates:—In the first line, M. Kirchhoff of Heidelberg. In the second line, and in alphabetical order, MM. Angström of Upsala, Billet of Dijon, Dove of Berlin, Grove of London, Henry of Philadelphia, Jacobi of St. Petersburg, Joule of Manchester, Lloyd of Dublin, Riess of Berlin, Stokes of Cambridge, Sir William Thomson of Glasgow, Tyndall of London, and Volpicelli of Rome. Forty-two members voted, and of these forty were for M. Kirchhoff and one each for Dr. Lloyd and Sir William Thomson. M. Kirchhoff was therefore declared elected. The nine correspondents in this section, therefore, are the following:—Hansteen of Christiania, Wheatstone of London, Plateau of Gand, Magnus of Berlin, Weber of Göttingen, Hirn of Logelbach, Helmholtz and Mayer of Heilbronn, and Kirchhoff of Heidelberg.

A memoir was presented from M. Lecoq, of Boisbaudran, describing some interesting observations on the relation of luminous spectra, and the length of the spark by which they are produced.

M. Quatrefages presented a note by M. Garrigou on the subject of some human bones split up longitudinally, and which were found in one of the bone caves. This, the author says, is another proof that the pre-historic races were in many cases cannibals.

M. H. Sainte Claire Deville announced the discovery of diamonds in the neighbourhood of Prague, in a deposit in which other precious stones, as zircons, sapphires, tourmalines, &c., had been previously found. The diamonds obtained cannot be distinguished from those of Brazil, and their density is 3·52.

M. Regnault presented a note by M. Blaserna of Palermo on the subject of induced currents. The author seeks to establish the fact that unless the direct current reaches a certain duration, there will be no induced current whatever.

M. Dumas presented a copy of M. Figuier's *Année scientifique et industrielle* for 1869.

SOCIÉTÉ PHILOMATHIQUE OF PARIS.

January 22nd.—At this meeting an important mechanical paper was read by M. de Caligny on an apparatus for raising water by utilizing the force of the waves of the sea or of great lakes. This contrivance is somewhat different from that described to the society some months since by the same member, and referred to in our report.

NOTES AND MEMORANDA.

The Testimonial to Professor Morris.—The penultimate general meeting of the committee was held at Haxell's Exeter Hall Hotel yesterday week, Professor James Tennant, F.G.S., F.Z.S., in the chair. The preliminaries were disposed of, and apologies offered by Mr. Henry Woodward and others for the absence of Sir Roderick I. Murchison, Bart. (the president), and two or three other members of the committee. The chairman, though regretting the absence of the president, could assure the meeting that it gave him infinite pleasure to occupy the chair at a meeting like the present—for determining the time and best mode of presenting a substantial testimonial to so old and valued a friend of his as Prof. Morris. He was glad to find that so large an amount had been already subscribed, and he had no doubt that as soon as a day was fixed as the last upon which subscriptions could be received many more names would be added. Mr. Woodward, F.G.S., said that, before any resolution was proposed, he would mention that Mr. Prestwich and Mr. Noble were ready to add £50 each to the list, upon the condition that the testimonial did not take the form of a useless though expensive present, and that not more than two or three guineas should be expended for a written record of the testimonial having been presented. Mr. Marshall Hall, J.P., thought the committee would agree unanimously with Mr. Prestwich that nothing useless should be presented. For his own part, he considered a purse, or its equivalent, the most sensible testimonial that could be given, as Prof. Morris could then purchase plate or not, at his discretion. Mr. W. P. Beale, F.G.S., concurred with Mr. Hall, and thought that if the honorary secretary would have a parchment written, stating the object of the testimonial, and followed by the names only of the subscribers, it would answer every purpose, and be well done by a law stationer very cheaply. Dr. Murie, Prosector Z.S., thought that the fund should be presented to Professor Morris free of any restriction whatever; indeed, if the testimonial were not given handsomely it would lose all its value—especially in the case of the man to whom it was to be presented. Mr. W. Milnes, F.G.S. (the treasurer), announced that the amount already at Messrs. Barclay & Co.'s was above £450, the only charge on the other side of the account being 7d. for collecting a Scotch draft—with the subscriptions of Mr. Prestwich, Mr. Noble, and others it would probably be about £600. The chairman said that, as to the time of presenting the testimonial, he would suggest, as February 19 was Professor Morris's birthday, it would be well to fix that day for the presentation, if there were no objection. The Rev. T. Wiltshire, M.A., V.P.G.S., remarked that it might be somewhat inconvenient to make it Feb. 19, as it was the day fixed for the Geological Society's annual meeting, but he thought they might consider it as presented on that day, although the actual presentation might be a little later. He concluded by moving "That the account be closed on Feb. 18, and that on Feb. 19 a cheque or deposit-receipt for the amount be handed to Professor Morris." The written portion of the testimonial could be given either with the deposit-receipt or afterwards. Mr. Marshall Hall seconded the resolution, which was carried unanimously. It was further resolved, on the proposition of the secretary, seconded by Dr. F. G. Finch, "That a sub-committee, consisting of Mr. Prestwich, Mr. A. Tylor, and the treasurer, be requested to carry out the foregoing resolution." Complimentary votes having been passed to the treasurer, &c., and to the chairman for his conduct in the chair, the meeting separated.

Platinized Looking-Glasses.—M. Jouglet has published an account of this method of silvering (if we may use the expression) mirrors. The plantinizing compound is prepared in the following manner:—100 grms. of very thin platinum foil is dissolved in aqua regia, the solution carefully evaporated to dryness, the solid chloride next placed on a triturating marble, and gradually mixed with essential oil of lavender. When 400 grms. of the latter have been incorporated with the chloride, the mixture is placed in a porcelain capsule and left standing for several days, the fluid is decanted from any sediment, and filtered as flux. For the above-named quantity of platinum, the following ingredients are used:—25 grms. of litharge and 25 grms. of borate of lead, mixed and triturated together with about 10 grms. of essence of lavender; this mixture is next mixed with the platinizing fluid. After a layer of platinum has been formed upon the glass, it is fixed by burning it in by placing the glass in peculiarly-constructed muffles.

Free and Cheap Steel for Rails, &c.—The *Builder* expects that the approaching expiration of Mr. Bessemer's patent for converting pig-iron into malleable iron, and that again into steel, without any additional consumption of fuel, will tend in a considerable degree to the future safety of railway passengers. The patent will come to an end this month, and as a result, it is expected that steel rails, which have hitherto been almost too expensive to be used, will fall to a price very little above that of the best iron. The projectors of new street tramways now will, no doubt, avail themselves of this material. Mr. Bessemer first communicated an account of his process to the meeting of the British Association at Cheltenham in 1856.

SCIENTIFIC DIARY.

WEDNESDAY, February 2nd.

Society of Arts, 8 p.m. "On Recent Improvements in Small Arms," by Capt. O. Hea.
Pharmaceutical Society, 8 p.m.
Royal Society of Literature, 8.30 p.m.
Social Science Association, 4 p.m. Executive Committee of Capital and Labour.
Obstetrical Society, 7 30 p.m. Council meeting. "On a Case of Cicatrices from a Burn, requiring Division during Labour," by Dr. Willoughby. "On a Case of Absence of the Vagina, with Retention of Menses in a Uterus behind," by Dr. Routh. "A Contribution to our Knowledge of Puerperal Fever," by Dr. Braxton Hicks.

THURSDAY, 3rd.

Royal Society, 8.30 p.m. "On the Fossil Mammals of Australia. Part III. *Diprotodon Australis*, Ow.," by Prof. Owen, F.R.S. "Note on an Extension of the Comparison of Magnetic Disturbances with Magnetic Effects, inferred from Observed Terrestrial Galvanic Currents, and Discussion of the Magnetic Effects inferred from Galvanic Currents on Days of Tranquil Magnetism," by the Astronomer Royal, F.R.S.
Society of Antiquaries, 8.30 p.m. "On some Ancient Oaken Coffins discovered in Northumberland," by T. W. Snaggo, Esq.
London Institution, 7.30 p.m.
Chemical Society, 8 p.m.
Royal Society Club, 6 p.m.
Society of Artists and Amateurs, 8 p.m.
Linnean Society, 8 p.m. "Revision of the Genera and Species of Capsular Gamophyllous Liliaceæ," by Mr. J. G. Baker. "On a New Form of Cephalopodous Ova," by Mr. C. Collingwood.
Harveian Society, 8 p.m. "On Induration in Syphilis," by M. De Meric.
Royal Institution, 3 p.m. "On Chemistry," by Prof. Odling.
Perthshire Society of Natural Science, 8.30 p.m. "On certain Parasitic Animals," and "On the Butterflies of Perthshire."
Bradford Philosophical Society, 8.15 p.m. "On a Scheme for the Scientific Exploration of Australia," by Prof. Neumayer.

FRIDAY, 4th.

Geologists' Association, 8 p.m.
Philological Society, 8 15 p.m. Paper by Mr. Whitley Stokes.
Royal Institution, 9 p.m. "On Verona," by Prof. Ruskin.
Archæological Institute, 4 p.m.
Social Science Association, 4 p.m. Executive Committee.
Western Medical and Surgical Society, 8 p.m. "On a Case of Obstruction in the Bowels," by Dr. Baines. "On a Case of Stone in the Urethra," by Dr. Painter.
Royal United Service Institute, 3 p.m. "Hints for Travelling and Campaigning," by Mr. W. B. Lord.

SATURDAY, 5th.

Royal Institution, 3 p.m. "On Meteorology," by Mr. R. Scott.

MONDAY, 7th.

Entomological Society, 7 p.m.
Medical Society of London, 8 p.m.
Victoria Institute, 8 p.m. "On the Numerical System of the Old Testament," by the Rev. Robinson Thornton, D.D., Vice-president.
London Institution, 4 p.m.
Royal Institution, 2 p.m. General monthly meeting.
King's College, 8 p.m. Prof. Guy's Lectures.
Torquay Natural History Society, noon. The first of twelve Lectures "On the Geology of Devonshire," by W. Pengelly, F.R.S.
[1] Social Science Association, 8 p.m. "On the Proposed Extension of the Contagious Diseases Act in its Moral and Economical Aspects," by Mrs Thomas Beggs.

TUESDAY, 8th.

Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8.30 p.m.
Photographic Society, 8 p.m. Anniversary.
Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.

[1] The announcement of the Association is for Monday the 8th!

Ethnological Society, 8 p.m. "On the Discovery of Flint Flakes under a Submerged Forest in West Somerset," by W. Boyd Dawkins, Esq., M.A., F.R.S. "On Remains of Prehistoric Man, in the neighbourhood of Crinan Canal, Argyleshire," by the Rev. R. J. Mapleton.
Manchester Literary and Philosophical Society, 7 p.m.
Richmond and North Riding Naturalists' Field Club, 8 p.m.

WEDNESDAY, 9th.

Geological Society, 8 p.m.
Graphic Society, 8 p.m.
Royal Microscopical Society, 8 p.m. Anniversary meeting, President's Address, &c. Annual election of officers.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.
Society of Arts. "On Loss of Life at Sea," by J. W. Wood, Esq.

ALLIED UNIVERSITIES CLUB.—Mr. Martin's letter has been received.

DUST AND DISEASE.—"D. F."—Your letter is to hand. We do not agree with you as to the explanation. Nevertheless the point you raise is of interest.

SIR W. THOMSON AND GEOLOGY. "R. A."—Mr. Menteath means to continue, but being particularly engaged just now is unable to take up the subject. We hope to publish a letter from him in an early issue. Nevertheless we shall be glad to hear from you in the mean time.

DUBLIN NATURAL HISTORY SOCIETY.—We regret that press of business prevented our meeting our correspondent. We shall be very glad to receive the reports regularly. "Dr. F." is thanked for his promise.

SUN-SPOT PERIODS.—Thanks. The expense of having the diagram engraved would be too great. We think the statements made are sufficiently intelligible without illustrations.

PRESERVATION OF HEALTH.—"J. B."—The subject is not scientifically dealt with. The remarks are of interest and useful, but not suited to our columns.

PHOTOGRAPHY AND ITS SCIENTIFIC APPLICATION.—"Nemo" is thanked for his good wishes. The paper is one which must have attracted a good deal of attention, but we do not think it is quite suited to our pages. If we had not much matter standing over we might try and insert it. But as matter stands we could not.

GEOLOGY AND THE "EDINBURGH REVIEW."—"P. W. S. M."—Your letter has reached us. We do not see our way to doing anything in the matter. We will look into it, however, and you shall see with what result.

RICHMOND NATURALISTS' CLUB.—"J. M."—Communication and card received. Why do you not send us also the titles of papers to be read? We shall be always happy to publish them, and to assist your society in any way in our power.

BRIGHTON AQUARIUM.—"W. A. L." —The letter was received just as we went to press. You will have seen what we have done on the subject. We shall be glad to learn further details, if possible.

MR. PROCTOR AND MR. ELVINS.—Our correspondent's letter has arrived, and appears to-day.

THE BIOLOGY OF MARANTACEÆ.—"C. D."—The proofs have been received, and our correspondent's wishes shall be complied with.

ITALIAN GEOLOGY.—"Stratum."—(1) We shall have the work reviewed in an early number. (2) We trust you will not be disappointed. (3) Use the Clinometer.

EARTHQUAKES IN PYRENEES.—"T. H."—Use the Seismograph. Some interesting experiments were made a few years since by the Rev. Samuel Haughton, F.R.S., of Trinity College, Dublin.

THE LATE PROFESSOR PURKINJE.—"J. B. R."—The death of this great physiologist took place some months ago (July 28th), at the ripe age of 82. A brief notice appears in SCIENTIFIC OPINION of August 15th.

TORONTO ASTRONOMY.—We omitted to mention, when replying to our correspondent, that we shall be happy to insert another letter from him.

CHILLED SHOT.—"W. G." will find a statement in our "Week."

GALVANOMETER.—We beg to apologize for the delay in replying to our correspondent's query. We hope to do so in our next.

INDUCED CURRENTS.—"J. B." will much oblige us by an early communication.

A YOUNG BEGINNER IN GEOLOGY.—"D. G. W."—Letter received. Look to our correspondence.

STAMPED NUMBERS.—"Cogito."—We regret that we cannot do what you want. The conditions would not answer, and we do not see how we could possibly benefit by a subscriber taking a copy for the purpose of sending it afterwards to non-subscribers.

BALTERIA LICHTENSTEIMANA.—Will the editor kindly lend us the blocks? An answer will oblige.

WEDNESDAY, FEBRUARY 9, 1870.

GOVERNMENT AID TO SCIENCE.

THE deputation composed of distinguished members of the Council of the British Association which, on Friday last, waited upon the Lord President of the Council and the Right Hon. W. E. Forster, M.P., for the purpose of urging upon the Government the desirability of appointing a Royal Commission to inquire into the present unsatisfactory relations of the State to Scientific instruction and investigation will, it is to be hoped, receive a favourable reply, and ultimately, we trust, be the means of placing the indisputable claims of Science to recognition in this country in a position upon a par with that which elsewhere in Europe has been universally accorded to them.

In the different branches of Natural Sciences we find on the Continent a comparatively vastly greater number of workers in the field, and a correspondingly abundant harvest of data tending to the advancement of Science, than can be seen on this side of the Channel. If now we inquire into the cause of this difference, the first point which at once fixes our attention is the fact that the ruling powers in those countries are ever on the alert to stimulate, encourage, and afford substantial assistance to scientific instruction and investigation; whilst, on the contrary, here in England, the Government contemplates the progress of Science with a serene indifference, seldom deeming it worthy of notice, unless when it is forced upon its attention by outward pressure, or when it expects, as, for example, in the case of the National Observatory, to receive an immediate and fully equivalent return for the pecuniary assistance it may grudgingly dole out.

If there is any country in the world which owes a debt to Science, surely it must be England, where there is the most ample evidence to prove that its high material position and wealth is in the main due to the development of branches of industry, dependent for their successful prosecution on the practical application of the laws of Science; yet, at the same time, it cannot but be admitted that the labour and expense attendant on scientific investigation has hitherto been all but entirely left to the unassisted exertions of the, but too often, needy men of Science, whilst the nation at large has slipped in and reaped the benefits.

The Earl of Harrowby, in his Address to the British Association, at Liverpool, in 1854, stated as an undeniable proposition, "That those who administer the affairs of the country ought, at least, to know enough of Science to appreciate its value and to be acquainted with its wants and bearings on the interests of society;" but the general apathy evinced by successive Governments, both before and since that time, does not seem to prove that this is the case in actuality. As the old saying has it, "Like master like man;" so in this case also we find that the general mass of the population of Great Britain, and in fact the majority of even what is commonly termed the educated classes, interest themselves so very little in all that pertains to Science, that it is almost sufficient to speak of a subject or publication as being scientific, to deter most people from attempting its study or perusal. This appears to be the chief reason why it is found that books, memoirs, or periodicals, which pretend to any scientific standing, do not as a rule pay, or at the utmost only command a sale or circulation barely sufficient to cover their expenses of publication, leaving but barren honours to their authors. How different is the case in France and Germany, where the proportion of the general public interested in the progress of Science is so great that even in the minor departments, or special branches of the Natural Sciences, we find that a copious literature can be supported!

Having recently inquired of an eminent German man of Science, well acquainted with England, as to what he considered was the reason of the backward state of Science in this country, he expressed his opinion that it never could be otherwise until the Government of the country would evince some greater interest in the advancement of Science, and, as in Germany, by means of moderate endowments and grants, enable men of Science to devote more time to the actual pursuit of the sciences which they teach, instead of, as at present, their being compelled to utilize every moment in struggling for a bare existence (and it is well known that there are "many offices filled by men of high scientific attainments, which are quite below the level which, at the general standard of living, befits the position of a gentleman").

"Should our professors," he added, "be placed in a similar position, I believe you would see even fewer scientific results brought forward than in England; for it surprises me greatly to observe, that the main results of English sciences are to be traced to the leisure moments of already overtasked scientific men."

All acquainted with the subject will, we are sure, quite agree with the remarks of the German professor; and, although the precise mode in which the State should aid and encourage Science is open to more mature consideration, there can be no question as to the desirability, in the first instance, of the appointment of a Royal Commission, in order that the subject may be fully ventilated; and we trust, therefore, that the request of the deputation may be granted by the Government without unnecessary delay.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

SIR RODERICK MURCHISON and Mr. Horace Waller, F.R.G.S., have both, in letters to the *Times*, endeavoured to show the improbability of the report of the death of Dr. Livingstone. But the truth of this report is shown to be still more unlikely by the fact that some weeks ago Messrs. Grant, Brodie, & Co., of Leadenhall-street, received a similar account from correspondents in St. Paul de Loango, who received it from a Portuguese trader, who, in his turn, received it from the ambassador of the Chief of Cazembe between the 15th and 25th of June, 1868, on the banks of the Zambesi. As Messrs. Grant, Brodie, & Co. observe, there need therefore be no alarm felt about the present rumour, seeing that Dr. Livingstone was at Cazembe's town in July, 1868, and at Ujiji in May or even July, 1869.

A DEPUTATION, consisting of members of the Council of the British Association for the Advancement of Science, and including Professors Stokes (president), Huxley (president-elect), Williamson, and Sylvester, waited on the Lord President of the Council on Friday, to urge the appointment of a Royal Commission to inquire into the relations of the State to scientific instruction and investigation, and to represent to him the conviction of the Council that no such inquiry would be complete which did not include the action of the State in relation to scientific education, and the effect of that action upon independent educational institutions. Earl de Grey promised the deputation to bring their views before the Government.

WE omitted to record last week the death of Mr. Sowerby, so well known in connection with *Sowerby's English Botany*. Subscribers and others will rejoice to hear that Mr. Sowerby has left his share of this great undertaking almost completed.

We regret to have to announce the death of Professor Brayley, F.R.S., of the London Institution. His presence cannot fail to be missed at the meetings of the Royal Society, in which he took such an active part.

Complaints having again been made against M. Leverrier, Director of the Paris Observatory, by some of the other officials, he has been removed from the post by an imperial decree dated February 5th. The administration of the Observatory is temporarily intrusted to a commission of three members.

We last week mentioned that the chair of Physical Science in the University of Dublin was to be conferred by competitive examination. The result of the examination is that the Rev. John R. Leslie, A.M., F.T.C.D., has been recommended as the candidate best qualified to fill the vacancy.

The following is the Syllabus just issued of Professor Flower's eighteen lectures introductory to the study of the Anatomy of the class Mammalia:—Methods and aims in the study of Morphology. Classification of the Mammalia. Osseous system of the Mammalia: Axial Skeleton—Vertebral Column; Modifications of the characters of the Vertebræ in the Cervical, Thoracic, Lumbar, Sacral, and Caudal regions in different mammals; Sternum; Cranium; Hyoid Arch. Appendicular Skeleton—Essential structure and modifications of the bones composing the Shoulder-Girdle and Anterior Extremity; Structure and modifications of the Pelvic Girdle and Posterior Extremity; Comparison between the structure and the functions of the Anterior and the Posterior Extremities. Tegumentary System and its Appendages: the Dermis; Modifications of the integument mainly due to peculiar conditions of the Dermis; Ossifications in the integument; the Epidermis and its modifications; Callosities, Scales, Nails, Claws, Hoofs, Horns, Hairs, Spines; Antlers; Glandular Organs connected with the integument or opening on the external surface of the body, Scent Glands, Mammary Glands. Dental System: Structure and essential characters of Teeth; Classification and Nomenclature of Teeth; Development and Succession of Teeth; Modifications of the characters of the Teeth in the different groups of the Mammalia; Horny structures taking the place of Teeth in certain mammals; Baleen, &c. The first lecture will be given on February 14th, at 4 o'clock, in the theatre of the Royal College of Surgeons.

The Royal Society of Edinburgh have elected Dr. Andrews, F.R.S., Vice-President of Queen's College, Belfast, an Honorary Fellow, in the place of the late Mr. Graham, Master of the Mint.

An examination will be held at Clare College, Cambridge, on Wednesday, March 30, beginning at 9 a.m., when the following minor scholarships will be offered for competition to students intending to begin residence in October:—two of £60 each for classics and mathematics, tenable for two years and a half, or till exchanged for a foundation scholarship, and one of £50 for natural science, tenable for three years and a half. Candidates for the £60 scholarships will be examined in the following subjects, preference being given to those who show special proficiency in either classics or mathematics:—Latin and Greek translation and composition; Euclid, algebra, plane trigonometry, geometrical and analytical conic sections, statics and dynamics, the subjects being treated without the aid of the Differential Calculus. Candidates for the £50 scholarship will be examined in chemistry, chemical physics (including light, heat, and electricity), comparative anatomy and physiology, and geology. Excellence in one, or two, of the above subjects will be preferred to a less perfect acquaintance with a greater number. Each candidate for this scholarship will be required to send to the tutor a list of those of the above subjects in which he desires to be examined at least three weeks before the examination. He will also be required to show that he possesses such acquaintance with Latin, Greek, and mathematics as will qualify him to pass the previous examination of the University. All candidates are required to send their names, with testimonials as to character, to the Rev. W. Raynes, tutor.

In a letter to Dr. Hooker, Colonel Playfair writes that a severe frost prevailed for the last three days of December in Algiers, and sheets of ice were found in the garden of the British consulate—a thing unknown since the occupation by the French.

The trustees of the Johnson Memorial Prize, University of Oxford, for the encouragement of the study of astronomy and meteorology propose the following subject for an essay:—"On the Laws of Wind.—1. With regard to Storms. 2. With regard to Average Periodical Phenomena at given Places on the Earth's Surface." The prize is open to all members of the University of Oxford, and consists of a gold medal of the value of ten guineas, together with so much of the dividends for four years on £338 Reduced Annuities as shall remain after the cost of the medal and other expenses have been defrayed. Candidates are to send their essays to the Registrar of the University under a sealed cover, marked "Johnson Memorial Prize Essay," on or before the 31st day of March, 1871, each candidate concealing his name, distinguishing his essay by a motto, and sending at the same time his name sealed up under another cover with the same motto written upon it. No essay will be received after the 31st day of March, 1871.

The authorities at Cambridge announce that an examination, commencing on Monday, July 4th, and continuing daily to July 9th, inclusive, will be open to women who have completed the age of eighteen years before January 1st. Candidates will be examined in such places as the syndics appointed by the university may determine. The syndicate will entertain applications from places where twenty-five fees at the least are guaranteed. Before any application for an examination be approved, the syndicate must be satisfied as to the following points:—1. That there is a committee of ladies who will efficiently superintend the examination, one of whom will undertake to act as local secretary. 2. That this committee will see that suitable accommodation can be obtained by candidates who are strangers to the place. 3. That a responsible person will be at hand to receive the examination papers from the conducting examiner, and collect the answers. Committees wishing to have examinations held in their several districts may obtain all necessary information from the Rev. T. Markby, Trinity Hall, Cambridge. No application will be considered which is received after April 1st.

The use of the term "degrees of frost" has been defended by Dr. Attfield against Mr. Symons, on account of its conformity with readings of the Centigrade scale. In reply, Mr. Symons has certainly brought a material objection against the use of the Centigrade scale for meteorological purposes, namely, that in recording temperatures near the freezing point the extra signs + — become necessary, and may be readily set down wrongly.

In reply to the request of the Council of the British Association for a subscription towards the cost of their proposed investigation of the subject of the utilization of sewage, the Metropolitan Board of Works state that they have not the power to comply with it.

In addition to the lecture arrangements in the University of Oxford which we published last week, the following have since been made:—Dr. Lee's reader in chemistry will deliver a course of lectures in the Christ Church Laboratory on Mondays and Wednesdays at 10 o'clock, intended for those who are commencing the study of chemistry. The first lecture was given on Monday, Feb. 7. Dr. Lee's reader in physics will deliver a course of lectures on Statics

in the Christ Church Laboratory on Tuesdays and Thursdays at 10 o'clock. These lectures will be experimental, and are intended for those who are commencing the study of mechanical philosophy. The first lecture will be given on Tuesday, February 15. A fee of £1 for each course is required from those who are not members of Christ Church.

A NEW illustrated monthly journal is announced to come out on March 1st, entitled the *Photographic Art Journal*, which will be illustrated with photographs printed in permanent pigments. Mr. Thomas Sutton is to be the editor.

AN Aurora of considerable beauty was visible on the evening of February 1st. A description of it appears in our "Correspondence." One writer notes a point of interest, namely, that both this display and the one on the 3rd ult. occurred shortly after the breaking up of a sharp and continued frost.

SIR JOHN LUBBOCK is now engaged on a work on the origin of civilization and the primitive condition of man. The first volume, on the moral and social condition of savages, is in the press, and will shortly be published by Messrs. Longmans.

THE education question still excites great interest. Several important meetings have been held during the week in different parts of the country. The proceedings were in all cases of the usual preliminary nature.

MOVING bogs are no novelty. We may however, chronicle the fact that nearly an acre of one of the Tipperary bogs became detached a few days since and floated to a distance of eight or ten perches.

DR. OLDHAM, the director of the Geological Survey, has given so favourable a report on the extent of the Chanda coal-deposits, as certain to supply the railway for 250 miles from Nagpore to its junction with the main line at Bhosawul, that a railway is to be surveyed from Wurdah to Chanda and the Godavery, so as to render the expense of cutting the third barrier of that river unnecessary.

MR. R. J. WATSON, senior in the Natural Sciences Tripos, December, 1869, has been elected to a studentship in Natural Science, at Queen's College, Cambridge.

THE new Barbette gun-carriage, made on the model of Captain Moncrieff, for a 12-ton gun, in the Royal Carriage depot of the Arsenal, Woolwich, was tested at the Arsenal proof butts in the presence of a host of military and scientific gentlemen interested in gunnery, amongst whom were Major-General Sir Hope Grant, Major-General Sir D. Wood, Major-General Sir J. Simmons, &c. Three rounds were fired with 240 lb. shot, viz., 30 lb., 40 lb., and 43 lb., all being effected with satisfactory results; and the inventor, at the close of the experiments, received the congratulations of the Ordnance Committee and the officers present.

AT its last meeting the Metropolitan Board of Works passed a resolution approving the report of the Royal Commission on Water Supply, and requesting the Chairman to seek an interview with the Home Secretary in order to ascertain whether the Government intend to move in the matter.

OWING to the state of the weather, telegraphic communication had practically ceased yesterday morning throughout the United Kingdom. Nottingham, Leeds, Sheffield, Hull, Newcastle, Brighton, and Southampton, were the only stations in communication with London. The Irish and Scotch wires had broken down. Liverpool and Manchester could not be reached. The fifteen western wires had been cut between Holborn and Paddington, and on an attempt being made to carry on communication from the latter station, it was found that no message could get beyond Reading. The Atlantic cable was out of order also.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

BRIEF REMARKS ON THE BIOLOGY AND GENEALOGY OF THE MARANTACEÆ.[1]

BY FEDERICO DELPINO.

IN TWO PARTS.—PART II.

WE must premise that for at least three years we attempted to decipher the biological signification of the floral structure in *Thalia dealbata*, and always without result. Finally, the discovery of Hildebrand placed us in the true road, and although, owing to the advanced season, we had only two or three flowers of the *Thalia dealbata* at our disposal, we succeeded in understanding its construction.

In this species the bursting loose of the style happens in an analogous manner to the above-described cases, and the difficulty of understanding the phenomenon consisted in the fact that, whilst in the Maranta the escape of the style is easily understood—as the style is sufficiently external—in the *Thalia dealbata*, on the contrary, it is somewhat turned inwards, and its escape happening in the interior of the flower cannot be easily understood except by one who anticipates a structure of this nature.

The differences offered by the flowers of the *Thalia dealbata* are slight. The apparatus may be considered as doubled. The inflorescence consists of a panicle terminating in bifloral spikelets, where the two flowers, wrapped up by a common bract (gluma) and by a bicarinate opposite bract (glumella),[2] flower contemporaneously, the one on the right the other on the left. These twin flowers, each of which taken separately is not symmetrical, are when taken together in perfect symmetry, as the parts of the right flower are inversely disposed to the homologous parts of the left flower. This would appear to point to unity of conception, and thus we should have in each spikelet of Thalia a true bifloral composite flower, and a double or bilateral dichogamical apparatus.

Hence the Thalia would occupy a higher rank in the scale of organical composition and of biological perfection than the other Marantaceæ. The structure of the style and the stigma is also somewhat more elaborated. The cavity in which the anther deposits the pollen is better marked, the viscid region is more extended, and the stigmatical cavity is deeper.

Finally, the style in escaping does not bend either into a curve or into a flat spiral, but coils into a helix.

The *Thalia dealbata*, which we have already observed for more than three years, matures seed in abundance at Florence, and its flowers are frequently visited by the common bee.

The Cannaceæ are closely allied to the Marantaceæ. Here also the pollen is deposited on an expansion of the style; but the dichogamical apparatus in the Cannaceæ is entirely changed, as it conforms to the labiate type.

The Orchids, however, show great marks of affinity with this group of plants. The most probable conjecture is that they

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[1] "Breve Cenno sulle Relazione Biologiche e Genealogiche delle Marantaceæ," di Federico Delpino (*Nuovo Giornale Bot. Ital.*, vol. i. No. 4, 1869).

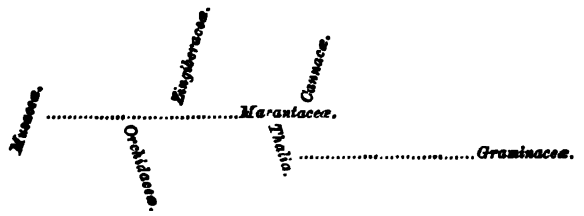
[2] We have the most profound conviction that the Graminaceæ are one of the descendants of the Scitaminæ, and, more precisely speaking, the descendants of a stock related to the type of the Thalia. In the organs of vegetation the most surprising conformity is found. After comparing the Graminaceæ and the Zingiberaceæ, the following common characters are observed:—*Nodous rhizoma, contorted in a similar way, leaves identically sheathed, ligulate* (!), *convoluted before foliation* (!), *distichous* (!). The culm, then, of *Thalia dealbata*, its panicle and bractæ, are evidently the culm, panicle, and bractæ of the Graminaceæ.

Then, in speaking of the Thalia, it may be permitted to use the expressions—culm, ligula, bifloral spicule, glume, bicarinate glumella.

We must not conceal the enormous differences which are met with in the flowers; but we ought to remember that the Zingiberaceæ are eminently entomophilous, whilst the Graminaceæ are become purely anemophilous—that is, fecundated exclusively by the wind; whence it is rational that with regard to these last, the coloured *involucres* should be quite aborted, and the stamens should have acquired long filaments.

Dichogamy would explain such differences up to a certain point.

are descended from a type till now unknown, which ought to reunite some of the characters of the Zingiberaceæ and of the Marantaceæ; that is to say, ought later to be the progenitor of both. In truth, the Orchidaceæ have a bilocular anther, like the Zingiberaceæ; a gynostema and a stigma somewhat analogous to that of the Marantaceæ and Cannaceæ.[3] Wishing to represent in a just and graphic manner our method of looking at the conjectural parentage of these plants, we give here a sketch of a genealogical tree, where the intermediate unknown types (true hypothetical roots, comparable to those which are of so much use in the study of organic chemistry) are shown by a linear series of dots.



Comparing these plants under the biological aspect of their dichogamical adaptations, they present enormous differences. If we take a flower of *Strelitzia regina*,[4] a flower of an Orchis,[5] a flower of Alpinia and of Hedychium,[6] a flower of Maranta, and finally a flower of Canna,[7] we shall find that the dichogamical apparatus differs fundamentally in each form; but it is remarkable that, notwithstanding this extreme diversity, there is something common to all, namely, the part which viscosity takes in securing dichogamy.

In the Strelitzia the pollen grains are united by viscous threads, in an analogous manner to that which happens in many Onagrariaceæ and Ericaceæ.[8] The stigma also is extremely viscid. In the Orchidaceæ viscidity is the means by which the pollen grains are united into pollen-masses and caudicles, and by its agency, the pollen-masses adhere in so strange a manner to the body of the insect-fertilizer. In the Zingiberaceæ the viscidity is produced from the margin of the dehiscent anthers, and causes the pollen to adhere to the back of the insects.

In the Marantaceæ viscidity is produced by the style in the narrow space which separates the depression where the pollen is deposited, from the stigmatic cavity.

Finally, in the Cannaceæ viscidity is entirely transferred to the pollen; in fact, the pollen adheres to the greatly polished surface of the style, on which it is temporarily deposited, until it is carried away by the insect-fertilizer.

The dichogamical apparatus of the Marantaceæ resembles in certain points that of the Cannaceæ. Whilst in the case of the Musaceæ, the Zingiberaceæ and the Orchidaceæ, the pollen is immediately ceded by the anthers to the insect-fertilizers; in the Marantaceæ and the Cannaceæ it is previously deposited on an expansion of the style. If we review the flowers of phanerogamic plants, we find such expedients repeat themselves in various families; that is to say, in the Campanulaceæ, in the Goodenoviæ, in the Brunoniaceæ, in the *Spigelia Marylandica*, and in the Proteaceæ. As might be expected in all these plants, the dehiscence of the anthers and the shedding of the pollen takes place before the opening of the flower, whilst it is likewise logical that in the case of all other plants it happens after the flower is open. To this *à priori* speculation the facts correspond, and with the above-mentioned plants, where the pollen is provisionally deposited from the anthers on the style, the dehiscence of the anthers always happens before the flower opens.

But neither the viscidity, nor the pollenical deposition constitute the most wonderful adaptation in the floral apparatus of the Marantaceæ. The fundamental adaptation which modifies all the other characters is the springing forth of the style. It forms, so to say, the soul of the apparatus. Elasticity which, in human industry, is employed with such frequency and profit, has been also made use of in the vegetable kingdom for biological aims or those belonging to the external life of plants.

We will not discuss the different kinds of elasticity employed for the purpose of dissemination (for example, in the genera Geranium, Oxalis, Momordica, &c.), and we will only mention some of the kinds which are employed in cross-fertilization.

In the family of the Orchids there is a trimorphic genus, of which one form is called Catasetum (masculine form), another Myanthus (hermaphrodite form), and the third Monachanthus (feminine form), in the erroneous belief that they form three distinct genera. Now, in the form Catasetum, if two irritable filiform processes, which exist in the flower, are touched, they cause the pollen-masses, which are extremely elastic, and are held for this purpose in a forced position to be ejected and shot against the insect-fertilizer, which has irritated the said processes, and by means of their viscous glands stick fast to a certain part of its body. This singular phenomenon, which has been described by C. Darwin, in his work on *The Fertilization of Orchids*, cannot be compared to that of the Marantaceæ, as it relates to the elasticity of the pollen-masses, not of the style.

Neither can it be compared with the elasticity of the ten stamens in the genus Kalmia, where the insect-fertilizer, entering the flower to suck the honey, and drawing the filaments somewhat backwards, causes the anthers to burst over it, and thus, strikng on its body from ten different sides, must cover it well with pollen, and necessitate promiscuous nuptials which otherwise could not take place.[9]

Professor Hildebrand has described and figured a case which is less dissimilar, in the *Bot. Zeit.*, August, 1866, pp. 75-76, tab. iv., figs. 10, 11, 12, 13. The *Lopezia coronata* is diandrous, or possibly monandrous, possessing a vertically projecting stamen with a well-developed anther, and from the lower part a staminodium which has a function precisely identical to that

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[3] The semi-anthered stamen of the Cannaceæ and the Marantaceæ is fused below its middle with the style: whence it represents a true gynostema, comparable to the more evolved and perfect one of the Orchidaceæ. The short viscid region of the style of the Marantaceæ is homologous with the viscid rostellum of the Orchidaceæ, under the morphological, as well as the physiological and biological aspects.

[4] See Hildebrand, *Bot. Zeit.*, July 30, 1869, pp. 506-509; and my publication, *Ulter. Osserv. sulla Dicog. a* pp. 222-223, vol. xii. *Degli Atti della Soc. It. di Sc. Nat. in Milano*, 1869. The observations on the flowers of Strelitzia come from Professor Hildebrand, as well as facts and figures contemporaneously and independently collected by me.

[5] See Charles Darwin, *On the various Contrivances by which Orchids are Fertilised*. London: 1862.

[6] See my publication, *Sugli Appar. della Fecondaz. nelle piante Antocarp.*, pp. 22, 23. Firenze: 1867. The Alpinia is a type of the floral structure which requires fertilisation by bees. In the Hedychium, instead of the Zingiberaceous apparatus, we find adaptation for the action of lepidopterous insect-fertilisers. In fact, in nearly all the stigmas of old flowers of several Hedychiums, I noticed that some scales of Lepidoptera had stuck.

[7] See *Sugli Appar. della Fecondaz.* &c., p. 23.

[8] This phenomenon is most evident in the species of Œnothera, the flowers of which are nocturnal, and open in the evening, indicating thus their exclusive fecundation by means of nocturnal or semi-nocturnal moths. One of these insects flying over a flower, and driving its proboscis into the honey-tube cannot fail to collect great festoons of pollen, part of which will be gathered by the humid and viscous stigmas of the flowers which are subsequently visited.

It is singular that this arrangement of viscous pollenical festoons, which constitutes the principal adaptation of the dichogamical apparatus of *Œnothera biennis* should have totally escaped C. C. Sprengel, notwithstanding his having perceived, with marvellous sagacity, the other relations both of the fecundation and dissemination of this species. (See *Entdeckte Geheimniss d. Nat. im Bau und in d. Befruchtung der Blumen*, pp. 317-323. Berlin: 1793.) In page 321, *loc. cit.*, Sprengel writes:—"I have never observed diurnal insects on its flowers" (*of Œ. biennis*) "except ants. But these cannot fecundate them. One rainy day, however, when the weather was dull, I perceived in my garden, at 11 o'clock a.m., a tolerably large crepuscular moth, which visited the flowers of this species and of *Œ. muricata*. His trunk was straight and nearly as long as his body. He drove it in the honey receptacle" (*Saftbälter, nectarosoncha*), "remaining, by means of the rapid beating of his wings, free, suspended, and immovable in the air, in such a way that he sucked the honey without danger of being bathed by the drops of rain which were in the petals. I tried to catch him, to see if his body, and especially the wings had gathered pollen, but I could not manage it."

Let it be observed that without examining the insect, it suffices to imitate the action of the sucking trunk with a small thorn or bristle, to see large festoons of pollen adhere to it.

[9] See *Atti della Soc. It. di Sc. Nat. di Milano*, vol. xii., 1869, pp. 121, 122. In this genus, if insects do not aid, neither dichogamy nor homogamy can take place.

of the Marantaceous staminodium which acts as a retainer. In fact, instead of the anther, a petaloidal cochleariform ridge is developed. This ridge embraces the anther of the superior stamen, which remains thus constrained in a forced position, and sub-tense towards the inferior part. When an insect strikes the cochleariform ridge, this escapes from top to bottom, whilst the anther escapes from bottom to top, and covers the insect-fertilizer with pollen in the corresponding part, when it will be placed in the mature flowers precisely at the point where the stigma is developed, for the Lopezia is eminently proterandrous [*i. e.*, the stamens mature before the stigma—Ed.]; the cross union between the stigmas of the mature flowers and the pollen of the young flowers by means of such elasticity is thus secured. Therefore this apparatus differs from that of the Marantaceæ, as the elasticity is in the stamens, not in the style.

But in several Leguminosæ we finally meet with an apparatus which repeats in a marvellous manner the general and special adaptation of the Marantaceous flowers.

Professor Hildebrand (*Bot. Zeit.*, 1866, p. 74) and ourselves (*App. fec. nelle antoc.*, 1867), with little divergence of view, and not knowing the one of the other, observed the said apparatus in the Medicago. But it also exists in the Indigofera, in the *Cytisus canariensis, C. albus* (Hildebrand, l.c.); in the *Genista pilosa, germanica, genuensis*, in the *Spartium junceum* (see *Atti della Soc. Ital. della Sc. Nat. in Milano*, 1868, vol. xi., pp. 311-317).

A few days ago in the botanical garden of Boboli, I noticed a similar and equally perfect apparatus in several species of Desmodium.

The apparatus for allowing the escape of the pistil, in almost all these Leguminosæ, offers surprising analogies with that of the Marantaceæ. The situation of the nectary (when it exists) at the base of the upper lip, the situation of the landing-place on the lower lip, the manner in which the style is forcibly retained, the escaping of the latter, the projection of the homoclinous pollen against the abdomen of the visiting insect, the simultaneous abrasion of heteroclinous pollen by the stigma, are all facts which occur from the same cause and with like effects in the above Leguminosæ as in the Marantaceæ.

In the genera Medicago and Indigofera, besides the bait of pollen, there is also the bait of honey; when the escape of the style has happened, the stigma rising up to the upper lip, closes definitively the access to the nectary; wherefore its flowers cannot be visited by insects more than once. We see the very same thing in the flowers of the Marantaceæ.

Thus these wonderful congruities are revealed in plants so different as are the Marantaceæ and the Papilionaceæ—congruities which confirm the real and not fantastical existence of this which we denominate "the papilionaceous dichogamical apparatus."

Florence, Sept. 7, 1869.

ON ORGANIC MATTER IN THE AIR.

BY DR. ANGUS SMITH, F.R.S.

I HAVE worked and written so constantly on impurities in air and water that last year I was told by a periodical of high position that I was quite regardless of the impression made on timid persons, and I began to compare myself to a collector of "varieties," who is often obliged to bring up his curiosities every five years. When I read of the new experiment by Professor Tyndall, showing to the naked eye the numberless bodies in the air, I was abundantly gratified, as I obtain them only by a laborious although simple process. When, however, Dr. Tyndall began to show the character of these bodies it "smote the chord of self," as I imagined that I had long ago proved that not only organic and inorganic, but organized forms exist in the atmosphere. Neither do I claim this as my original idea, looking rather to the fulness of proof and quantitative results as mine. I think, therefore, I may remind my friends of some of my work, as I find that they forget, and even I forget, the exact words used by myself, and must read up.

But as people don't read much on a subject, I will begin at the end. I have been for two years attempting to measure the amount of putrescible matter in the air of the towns and country places, and I have succeeded to a considerable extent. I also measure the amount that has putrefied and left its remains in the air—the sewage of the atmosphere. Some of my results are published; I have promised some very soon, and some have been ready for printing, under the head of *Chemical Climatology*. The proof of organic matter is old. I seek the quantity in various towns and parts of towns.

I shall not here give a history of the inquiries. So many people claim to have something to say in the matter, that I might amuse myself, if not the public, by a long account. At present I profess to keep almost entirely to my own work. The knowledge of organic matter in the air has never been absent entirely from men's minds in historic times; but the words of Bishop Berkeley are so clear that I prefer to quote them. Besides, he is far enough back for the purpose. He says in *Siris* (par. 140):—

"Nothing ferments, vegetates, or putrefies without air, which operates with all the virtues of the bodies included in it, that is, of all nature. . . . . The air, therefore, is an active mass of numberless different principles, the general sources of corruption and generation; on the one hand, dividing, abrading, and carrying off the particles of bodies, that is, corrupting or dissolving them; on the other, producing new ones into being, destroying and bestowing forms without intermission."

And in paragraph 141 he says:—

"The seeds of things seem to be latent in the air, ready to pair, and produce their kind whenever they light on a proper matrix. The extremely small seeds of ferns, mosses, mushrooms, and some other plants, are concealed and wafted about in the air, every part whereof seems replete with seeds of one kind or other. The whole atmosphere seems alive. There is everywhere acid to corrode and seed to engender. Iron will rust and mould will grow in all places."

No man has before or after him expressed this truth more completely and beautifully. It is hard to improve it by one word. Still, this age demands more detailed knowledge and exact theory; besides, the work of every few years requires to be done again to suit modern methods, although it must be confessed that there is room for the cynic to say that Bishop Berkeley and all the ancients and moderns might be classed with Topsy, who think they have explained all by saying, "It grows."

I began to examine the air in 1846, and I brought a short notice before the Chemical Society: a simple mode of obtaining organic matter in the condensed breath on windows is recorded in their *Transactions*. On account of this commencement which promised favourably, the British Association requested me to report on the subject. My report, published in 1848, was considered to have made advance, and was marked out for special mention by the president of the succeeding year, so that the words were not hidden. I quote a part. "That animals constantly give out a quantity of solid organic matter from the lungs may readily be proved by breathing through a tube into a bottle, when the liquid, or condensed breath, will be collected at the bottom of the bottle; or by breathing through a tube into water, when a solution of the same substance will be found in the water. This would scarcely require proof if we consider that breath so frequently has an organic smell."

"If this condensed breath be put on a piece of platinum, or on a piece of white porcelain, and burnt, the charcoal which remains and the smell of organic matter will be conclusive. If it be allowed to stand for a few days (about a week is enough), it will then show itself more decidedly by becoming the abode of small animals. These are rather to be styled animacules,

and very small ones certainly, unless a considerable quantity of liquid be obtained: they may be seen with a good microscope. Animalcules are now generally believed to come from the atmosphere, and to deposit themselves on convenient feeding-places; that is, they only appear where there is food or materials for their growth, and they prove of course the existence of that continuation of elements necessary for organic life. At the same time their presence is a proof of decomposing matter, as their production is one of the various ways in which organized structure may be broken up."

"I mentioned some time ago that I had got a quantity of organic matter from the windows of a crowded room, and I have since frequently repeated the experiment. This matter condenses on the glass and walls in cold weather, and may be taken up by means of a pipette. If allowed to stand some time it forms a thick, apparently glutinous, mass; but when this is examined by a microscope it is seen to be a closely-matted confervoid growth, or in other words, the organic matter is converted into confervæ, as it probably would have been converted into any kind of vegetation that happened to take root. Between the stalks of these confervæ are to be seen a number of greenish globules constantly moving about, various species of Volvox, accompanied also by monads many times smaller. When this happens, the scene is certainly lively and the sight beautiful, but before this occurs the odour of perspiration may be distinctly perceived, especially if the vessel containing the liquid be placed in boiling water.

"If air be passed through water a certain amount of this material is obtained, but I have found it difficult to pass a sufficient quantity through. If it is made to pass rapidly, absorption does not take place, and evaporation of the water is the consequence; if it passes slowly, it requires several weeks to pass a hundred cubic feet through a small quantity of water. I continued the experiment for three months, but although I obtained sulphuric acid, chlorine, and a substance resembling impure albumen, I did not get enough to make a complete examination; and, indeed, this could not be expected, as I found that in that time less than a thousand gallons of air had passed through.

"When this exhalation from animals is condensed on a cold body, it in course of time dries up, and leaves a somewhat gelatinous organic plaster; we often see a substance of this nature on the furniture of dirty houses, and in this case there is always a disagreeable smell perceptible."—*Mems. Brit. Association, Meeting held in August*, 1848.

I quote the words used by the President of the Association simply to show that the paper was well known:—

"For instance, the causes which in our great cities hasten the death and debase and embitter the life of so many, have at last been forced by chemists and physiologists on the notice of the public. Look at Dr. Smith's report on the air and water of towns, in this volume; and when we think that the victims of the deadly influences which are there revealed are chiefly found among the people whose industry is the foundation of our greatness,—that every year cut off from the life of each of these is so much subtracted from national wealth,—even were all moral sense and religious feeling dead in us, we must confess that the knowledge which is capable of averting them 'is of use.'"

Looking over these words at this distance of time it seems to me scarcely possible to write more clearly, although some of the words I should prefer to see changed. Still the subject was a continued study, and it was my strong desire to measure exactly the amount of organic matter. Not to detail all the attempts, I may come to the report to the Cattle Plague Commission in 1866, in which I give some general views and allude to the works of others. The following may be quoted:—

"It has often been asked—Will a sewer produce cholera, or plague, or cattle disease? We cannot say so, or that every kind of disease may be produced from such accumulations of organic matter. The great epidemics that have passed over Europe seem always to have come from some extraneous source, to act *as if planted by some seed*, and not to have risen up spontaneously here. Without attempting to examine this matter carefully, the result would seem to be, that whilst the decomposition of organized beings after death produces gases and vapours that are opposed to health, these gases or vapours are incapable of originating, although they may be capable of feeding, some of those diseases, such as cholera or plague, which have been observed at all times to come from a warmer climate. There must, however, be some first origin of these diseases, and we cannot prove that the first origin might not take place in our climate, although it seems probable that it requires a warmer sun and a richer vegetation than is to be found in the north. This, however, is sufficiently made out—that, when these diseases do come amongst us, they take root with most effect in those places where decomposing matter is found. If we were to suppose a seed of disease planted in a rich, fertile soil of decomposing matter, we should give a pretty fair description of the fostering effect of impurity on disease. It would in fact appear as if the putrid matter itself took the disease, and transferred it to the living. There seems to be nothing entirely opposed to this view of the case. The question, however, is and has always been—What is the nature of that substance which may be said to form the seed or germ of the disease? Chemists have been inclined to consider it a substance in process of decay, as the quotation from Liebig already given shows. Physiologists and microscopists have been more inclined to consider it as an organized substance. When Gay Lussac passed a bubble of air into the juice of grapes, and found that fermentation began at once, it was believed that the oxygen was the prime mover, and that, when once begun, the action did not cease. When, however, Dusch and Shroeder found that flesh did not decompose if the air was previously passed through a good filter of cotton wool, some difficulty was thrown on the subject. It would appear as if oxygen were not the only agent in the atmosphere causing decomposition. The investigations of M. Pasteur, who found the subject in this uncertain condition, have advanced it so far that we may now with certainty reason in the belief that organized substances are really found in great abundance in the atmosphere (in all places), and that they are the cause of some hitherto entirely mysterious phenomena, putrefaction included. His object was first to inquire into the possibility of spontaneous generation, and he found that carefully filtered air allowed no organisms to appear in vegetable solutions. He found that near the usual surface of the ground these organisms were so numerous that whenever a vessel containing vegetable matter fit for their growth was opened for a very short time they were found to enter; that in cellars and damp and quiet places, where there was no air or dust floating about, these organisms were fewer; and that, as he ascended the sides of the Alps and the Jura, they diminished in number. A commission of the French Academy confirmed his results. If we examine previous inquiries into the compounds resulting from the decomposition of organic substances, we shall find nothing which is at all calculated to bring out such an intelligible rational view of the origin of many diseases, and also of some phases of putrefaction. Chemists when they have examined products of the latter action have found sulphuretted hydrogen, carburetted hydrogen, carbonic acid, nitrogen, hydrogen, ammonia, acetic acid, lactic acid, butyric acid, and numerous uncertain bodies having no activity, and utterly incapable of producing those prodigious results that are found when that force begins to work which produces plague, small-pox, or black death."

I did not enter on Pasteur's ground—the action of organisms in producing fermentation.

After these opinions and the detail of many facts, one is mentioned which was the culminating point of the inquiry, and has led to a mode of collecting the organic particles of air,

which I may call established. This word "established" is used because the experiment has been done by others. It is given in these few but plain words:—"The air of cowhouses and stables is to be recognized as containing more particles than the air of the street in which my laboratory is, and of the room in which I sit, and that it contains minute bodies, *which sometimes move, if not at first, yet after a time, even if the bottle has not been opened in the interval.* There is found in reality a considerable mass of *débris* with hairs or fine fibres, which even the eye, or at least a good pocket lens, can detect. After making about two dozen trials, we have not been able to obtain it otherwise. Even in the quiet office at the laboratory there seemed some indications."

"I found similar indications in a cowhouse with healthy cows; so I do not pretend to have distinguished the poison of cattle plague in these forms; but it is clear that where these exist there may be room for any ferment or fomites of disease; *and I do not doubt that one class is the poison itself in its earliest stage.* It would be interesting to develop it farther."

I do not detail the examination made of the condensed air brought from a cowhouse by Mr. Crookes, nor do I detail the examination of the cotton through which Mr. Crookes had passed the air, nor the glycerine surfaces exposed to the air of cowhouses, which also was done by Mr. Crookes. My object at present is not to give a history, but a few of the prominent points so far as relates solely to my own part.

These experiments were repeated on air in Manchester. A paper was read on the 30th March, 1868, to the Lit. and Phil. Society, Manchester. Dr. Schunck in the chair. To quote a part:—

"Lately I tried the same plan on a larger scale. A bottle of the capacity of 4·990 c.c. was filled with air and shaken with water. The bottle was again filled and shaken with the same water, and this was repeated 500 times, nearly equal to 2½ millions cb.c., or 2·495 litres. As this could not be done in a short time, there was considerable variety of weather, but chiefly dry with a westerly wind. The operation was conducted behind my laboratory, in the neighbourhood of places not very clear, it is true, but from which the wind was blowing to all parts of the town. I did not observe any dust blowing, but if there were dust, it was such as we may be called on to breathe. The liquid was clouded, and the unaided eye could perceive that particles very light were floating. When examined by a microscope the scene was varied in a very high degree—there was evidently organic life. I thought it better to carry the whole to Mr. Dancer, and to leave him to do the rest, as my knowledge of microscopic forms is so trifling compared to his."

Having for years therefore convinced myself of these results, I took the air washings to Mr. Dancer, of Manchester, whose experience in microscopic objects is so great that I was certain to be corrected if I erred, and if I did not err I should be taught more. His examination is very beautiful, and it shows not only organic substances, but very many in quality and inconceivably many as to quantity. The whole cannot be be quoted, but the following will suffice.

"The water was first examined with a power of 50 diameters only, for the purpose of getting a general knowledge of its contents. Afterwards magnifying powers varying from 120 to 1,600 diameters were employed.

"During the first observations, few living organisms were noticed; but, as it afterwards proved, the germs of plant and animal life (probably in a dormant condition) were present.

"1st. Fungoid Matter.—Spores or sporidiæ appeared in numbers, and, to ascertain as nearly as possible the numerical proportion of these minute bodies in a single drop of the fluid, the contents of the bottle were well shaken, and then one drop was taken up with a pipette; this was spread out by compression to a circle half an inch in diameter. A magnifying power was then employed which gave a field of view of an area exactly 100th of an inch in diameter, and it was found that more than 100 spores were contained in this space; consequently, the average number of spores in a single drop woul be 250,000.

"On the third day a number of ciliated zoospores were observed moving freely among the sporidiæ.

"Some of this formed a very interesting object, with a high power, and the greater portion exhibited what is called pitted structure. The larger particles of this had evidently been partially burnt and quite brown in colour, and were from coniferous plants, showing with great distinctness the broad marginal bands surrounding the pits; others had reticulations small in diameter. They reminded me of perforated particles so abundant in some kinds of coal.

"Along with these reticulated objects were fragments of vegetation, resembling in structure hay and straw and hay seeds, and some extremely thin and transparent tissue showing no structure.

"A few hairs of leaves of plants and fibres, similar in appearance to flax, were seen, and as might have been expected in this city, cotton filaments, some white, others coloured, were numerous—red and blue being the predominant colours. A few granules of starch, seen by the aid of the polariscope, and several long elliptical bodies, similar to the pollen of the lily, were noticed. After this dust from the atmosphere had been kept quiet for three or four days, animalcules made their appearance in considerable numbers, the monads being the most numerous. Amongst these were noticed some comparatively large specimens of *Paramecium aurelia*, in company with some very active rotiferæ; but after a few days the animal life rapidly decreased, and in twelve days no animalcules could be detected.

"For the purpose of obtaining a rough approximation of the number of spores or germs of organic matter contained in the fluid received from Dr. Smith, I measured a quantity by the pipette, and found it contained 150 drops of the size used in each examination. Now I have previously stated that in each drop there were about 250,000 of these spores, and as there were 150 drops the sum total reaches the startling number of 37½ millions."

After these examples, the first being twenty-four years earlier than the last, I need not add that my certain knowledge is that particles both organic and inorganic are found in air.

Further, that some of the organic particles are organized.

Lime, soda, sulphates, and chlorides have been mentioned in another paper as being found, coal ash, and of course carbon, and to some extent the amount measured. In railway carriages we even breathe rolled plates of metallic iron which are large enough to be seen by the naked eye.

Some of the most difficult particles to remove are those of coal smoke. They are oily or tarry, or both. These are instances of organic and not organized particles.

For two years I have been endeavouring to measure with certainty the amount of nitrogen in the organic matter, separating it from the inorganic. Some of the results are in the last "Report of the Proceedings under the Alkali Act," and have been pretty extensively published. Other results are soon to be published.

I have not yet spoken of my work, *On the Air of Mines*, where drawings of the particles of solid matter are given (in a long report published by the Mines Commission in 1864), because the air was from exceptional places. Still, similar results are got above ground. In the small tubes containing air from the mines and solids I was able to detect very distinctly organic matter and to measure the ammonia.

Still, the best proofs are in the sight of actual forms and the moving objects. In finding these with many accessories I consider their existence in the air of such places as were tried proved beyond all doubt, also long ago proved. We now require good microscopists to examine the individual forms and to find if every disease has one peculiar to itself, as Mr. Bailey

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finds every class of plants has its own peculiar pollen. That is probably the next most prolific field for those who desire something more on the subject.

We must not be panic-stricken because of these forms. Some are very hurtful, but it may be that others are required for the maintenance of healthy animal life of the highest order, exactly as in vegetable fermentation. We must purify the air within the limits of natural intention, and be careful that we do not overstep its boundaries.—*Paper read before the Literary and Philosophical Society of Manchester*, Jan. 25.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From January 30th to February 5th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
4 Pine Grosbeaks (Corythus enucleator) 2 ♂ and 2 ♀	British Islands.....	Purchased.....	Western Aviary
2 Chinese Pigs (Sus scrofa, var. sinensis) ♀	China	Presented by Alfred G. Stagg, Esq.....	Top Yard
2 Summer Ducks (Aix sponsa) ♀	North America.....	Purchased.....	Round Pond
1 Spotted Cavy (Calogenys paca)	Trinidad	Presented by E. C. Moore, Esq.	Rodent-house
2 Pairs Mandarin Ducks (Aix galericulata)	China	Purchased.....	Mandarin Pond
2 Mandarin Ducks (Aix galericulata) ♀	Ditto.....	Ditto.....	Ditto
2 Mocking-birks (Mimus polyglottus)	North America.....	Ditto.....	Western Aviary
1 Black-sided Hangnest (Icterus abeillœi)*	Mexico	Ditto.....	Ditto
1 Cat-bird (Galeoscoptes carolinensis)	North America.....	Ditto.....	Ditto
1 Solitary Thrush (Petrocincha cyanea)	Europe	Ditto.....	Ditto
7 Ruddy Finches (Carpodacus Erythrinus)	Siberia	Ditto.....	Ditto
1 Macaque Monkey (Macacus cynomolgus) ♂	India.....	Presented by T. Douglas Murray, Esq.	Monkey-house
1 Bonnet Monkey (Macacus radiatus)	Continental India...	Deposited by Lieut.-Col. Addison	Ditto
1 Macaque Monkey (Macacus cynomolgus) ♂	India.....	Ditto.....	Ditto
1 Ditto ditto	Ditto.....	Deposited by Capt. Wingfield	Ditto

♂ Male. ♀ Female. * Never previously exhibited.

THE WARSOP AËRO-STEAM ENGINE.

In the *Times* of the 24th of August, 1869, in the report of the proceedings of the British Association for the Advancement of Science, there was a short abstract of a paper by Mr. Eaton, giving an account of certain economical improvements in obtaining motive-power. The essential feature of the arrangement described was the addition of an air-pump to an ordinary high-pressure steam-engine. Air condensed from this pump was driven into a tube, which was carried at first within the exhaust steam-pipe, next in a spiral course within the funnel, and which finally entered at the lower part of the boiler, where it terminated in a large circle, pierced by numerous very fine openings, from which the compressed and heated air bubbled up through the water, imparting heat to it, breaking up its cohesion, and, so to speak, preparing it for ebullition. The original idea of the inventor was simply to economize fuel in the production of force. He conceived that the air would not only preserve and convey to the water a large amount of heat that would otherwise be wasted, but that the bubbles would enormously increase the surface on which heat could act, and would represent, in effect, an infinite number of minute tubes. He thus expected to boil the water with less expenditure of coal, and the results of his experiments, after preliminary difficulties had been overcome, were sufficiently satisfactory to justify expectations of great ultimate success. The inventor himself, Mr. George Warsop, is a working mechanic who has long been favourably known at Nottingham, where he resides, as the possessor in an unusual degree of the inventive faculty; and Mr. Eaton, also of Nottingham, to whose paper we have referred, has supplied him with the necessary means for the development of his plans, as well as with facilities of access to men of science and practical engineers. As soon as he became satisfied of the actual value of his invention, Mr. Warsop obtained a patent, of which Mr. Eaton and he are now joint owners. They have given to their improved engine the somewhat remarkable Greco-Saxon appellation which stands at the head of the present article, and they are now prepared to bring it into general operation.

The first impartial report on the working of the improvement was furnished by Messrs. Easton & Amos, who were commissioned by Mr. Eaton to go to Nottingham, and to conduct a series of experiments with a stationary engine there set up. As the air-pump could be put out of gear at any time, these experiments were comparative, and were made upon the same engine, with and without the addition of the Warsop system. Messrs. Easton & Amos found an engine on the ordinary overhead direct-action system, having the usual slide-valve motion, and the addition of a compressing air-pump, worked by a throw formed in the crank-shaft. A feed-pump of the common kind supplied the boiler, which was of the Cornish multitubular description, seated in brickwork, and furnished with the usual mountings and fittings. The air, on leaving the compressing pump, was passed into a coil inclosed in a vertical exhaust-heater, and continued within the exhaust pipe. Passing from this into another coil descending within the chimney uptake, it entered a line of pipes contained in the flues beneath the boiler. Traversing a coil in the smoke-box of sufficiently large diameter to allow the boiler tubes to be freely cleaned, it passed again through the flue pipes on its return, and entered the boiler by means of a check valve at the front. From this it made its passage into the water through a perforated distributing pipe coming beneath the fire flue, and allowing it to escape in numerous small jets. The air was thus entirely heated by the waste gases, &c., on their passage to the chimney, and by the heat taken up from the exhaust steam in the passage through the heater or regenerator. A Prony break, with all the latest improvements, was employed as the measure of useful work done; and the experiments were conducted in accordance with the following programme:—

1. To get the engine into regular and steady working order, the firing even and constant, and then to ascertain what load upon the friction break could be properly maintained; the starting valve being fully open and the boiler pressure being kept at what could be regularly and comfortably sustained by the steady firing before mentioned, the engine working as a simple steam-engine under these circumstances.

2. To draw the fire completely, lighting again immediately with weighed coal; and, allowing a few pounds of pressure to accumulate (in compensation for the falling off of pressure occasioned by drawing the fire), to start immediately, with the ascertained proper load upon the break, and to run a continuous steady trial for a considerable time, taking indicator diagrams, noting the pressure and temperature inside the boiler,

and generally determining the amount of work performed by a given quantity of fuel, the consumption of which would conclude the trial by bringing the engine to a stand-still.

3. With the same break-load and the conditions in all respects the same, to run a like trial with the engine in its combined form, noting the same points and again determining the amount of work performed by a given quantity of fuel.

4. To ascertain by friction diagrams the power consumed in working the air-pump.

The gross result obtained was that the engine consumed 140lb. of coal, when working with steam alone, in 196 minutes, and, when working with steam and air, in 234 minutes. During the former period the break, weighted with 120lb., made a total of 17,825 revolutions, or an average of 90·94 per minute, and during the latter a total of 22,815 revolutions, or an average of 97·5 per minute. With steam alone the gross horse-power of useful work done during the experiment amounted to 1,115·7; with steam and air, to 1,428·05. On the Warsop system the fuel not only lasted longer, but it also produced a greater effect during an equal period of time.

It was then thought desirable to institute a further series of experiments, under conditions which would obtain in ordinary daily work, and which may be thus stated:—

1. Maintaining the break-load as before (120lb.), to fire evenly and steadily with weighed coal, and to drive at as uniform a rate as possible, doing the greatest possible amount of work with the fuel allowed, and discontinuing the experiment when, owing to the expenditure of fuel, the engine could no longer maintain her speed, and the steam pressure ran down; the engine to be working in the combined form, and care being taken to note the pressure and temperature in the boiler, the pressure in the air-main, the amount of feed water supplied to the boiler, and the power developed.

2. Under like circumstances to run a corresponding trial with the air-pump disconnected, and to note the same facts as before.

The results are stated below, it being premised that the experiments were always commenced with a boiler pressure of 50lb.; and that, according to the practice of the Royal Agricultural Society, the fuel was deemed to be exhausted when 90 revolutions of the engine per minute could no longer be maintained.—Coal consumed, with steam and air, 120lb.; with steam only, 120lb.; duration of experiment, with steam and air, 153 minutes; with steam only, 112 minutes; number of revolutions of break, with steam and air, 15,433; with steam only, 10,500; average number of revolutions per minute, with steam and air, 100·8; with steam only, 93·75. Gross horse-power of useful work done during experiment, with steam and air, 965·9; with steam only, 657·22. Average horse-power of ditto, with steam and air, 6·31; with steam only, 5·86. Pounds of water consumed for each pound of coal burnt, with steam and air, 8·37; with steam only, 6·13.

In considering the value to be attached to these results, it was plain that the comparatively inferior performance of an ordinary "commercial engine" left a larger margin for improvement than would be likely to exist in engines of the best finish and quality. At the same time the experimental saving of fuel by the Warsop system amounted to no less than 47 per cent.; and even half of this saving, if it could be realized in actual practice, would add enormously to the usefulness of steam-power, especially for the purpose of either land or water transit. The system is said by the inventor to be particularly well adapted to railway locomotives; but with these none but private experiments have as yet been made. In navigation, however, we are able to record the commencement of actual work, since an iron screw steamer with a Warsop engine has been built at Middlesbrough-upon-Tees, and is at present carrying cargo. She is named the *Fox*, and is intended for coasting purposes. She is schooner-rigged, carries 230 tons of dead weight, and was built by Messrs. Backhouse & Dixon, of Middlesbrough, for her owners, Messrs. Williams & Purvis. Her engines are by Messrs. Joy & Co., of Middlesbrough, and have a high-pressure boiler weighted to 60 lb., and two cylinders of 15½ in. diameter and 13 in. stroke. The boiler is vertical and cylindrical, with cylindrical furnace inside and cross tubes from side to side, the uptake passing through the steam as superheater. The air-pump is placed vertically above one of the cylinders, and its piston is 11 in. in diameter, with 8 in. stroke. The first trial trip of the *Fox* was made on the 13th of December, 1869. She left Middlesbrough at 11.41 a.m., and went down the Tees under steam only, with a strong land wind blowing. She had neither ballast nor cargo, and rolled very much. She crossed the bar about 12.20, and got out to sea. The steam-pressure was let down to 28 lb., with only 2 in. of water in the gauge-glass, and a thin fire. At 12.40 the air was turned on, with the engine feed-pump at full work pumping through the feed-heater, and the donkey running slowly, pumping cold water into the boiler. At 12.58 the boiler-pressure had gone up to 55 lb., and from the continued feed the water in the glass stood at 10 in. The engines were allowed full steam both at the stop-valve and at the expansion lever. At 1.30 and thenceforward, the engines still working full speed, the boiler pressure stood at 60 lb., and there was no priming. As an experiment, with this pressure and the screw making 112 revolutions, the air was shut off. Within two minutes water began to pass into the cylinders, and in three minutes the revolutions had fallen to 100. The air was again turned on, and in three minutes all priming had ceased, and the screw was again making 112 revolutions. From the heavy wind and the lightness of the vessel she was scarcely manageable, and the trip was brought to a premature close, having shown only that the engines worked well, and that the Warsop system prevented priming. A few days later she was taking cargo from Middlesbrough to Berwick, when, between Hartlepool and Shields, with the Warsop system in full operation, a pressure of 60 lb., and the screw making 126 revolutions, the nut of a valve broke and disabled the air-pump for a time. It was immediately necessary to reduce the pressure on account of priming, and nothing above 30 lb. and 90 revolutions of the screw could be maintained for the rest of the trip. The captain calculated that the stoppage of the air-supply lost three hours' time in a passage that occupied eleven.

The next trip of the *Fox* was to Aberdeen, and on this, after five hours' steaming on the Warsop system, the air was turned off, and she was kept for five hours under steam alone. In the five hours under steam and air she ran by log 32½ miles, averaging 97½ revolutions per minute, and with an average boiler pressure of 50 lb., and no priming. In the five hours under steam alone she ran by log 24½ miles, averaging only 71 revolutions per minute, with an average pressure of 35 lb., and primed whenever the pressure reached 39. Under steam alone the consumption of coal was 345 lb. per hour, and under steam and air it was 271 lb. per hour; showing a saving of 27·3 per cent. of fuel, besides the increase in the rate of speed. It will be observed that the speed was never high, but the engines of the *Fox* are only of 35-horse power, and are not calculated to lift her cargo at any rapid rate. The representative of the patentees had considerable difficulty in persuading the captain and the engineer to complete the five hours under steam alone. They said that they had evidence enough, and that they wanted to get on.

The *Fox* has now been chartered by Messrs. Breslauer and Co., of Gracechurch-street, to run as a regular trader for the conveyance of goods between London and Exeter. There is a sister ship, the *Lynx*, belonging to the same owners, and precisely similar to the *Fox* in all respects, except that her engines have no air-pump. Arrangements have been made to compare the performances of the two vessels over a period of some months, noting their number of hours under steam, the total distance accomplished, and the total coal consumed by each.

The question of priming is regarded by naval engineers as one of high importance; and, for the sake of those not conversant with the subject, it may be as well to explain what it

means. The priming of a steam-engine is analogous to the "boiling over" of a saucepan. Instead of steam alone leaving the boiler, water goes with it, and, by passing into the cylinders, materially impairs the work. The water then escapes from the cylinders with the exhaust steam, goes into the funnel, mingles there with soot and smoke, and descends in a black shower upon the unfortunate occupants of the deck. Besides wasting power and producing dirt and annoyance, priming often produces danger. It consumes the water so much in excess of the ordinary rate that, if special attention be not paid to the gauge-glass, it may easily fall too low, and the result may be an explosion. To this cause the recent melancholy accident on board the *Thistle* is supposed to have been due.

Among the causes of priming, two are especially prominent. They are—dirtiness of the water, leading to the formation of a viscid scum on its surface, and a high degree of boiler pressure. It is presumed that the air prevents priming by breaking the continuity of the scum; but, whatever may be the explanation, the few trials hitherto made seem to show that the Warsop system will permit a high rate of pressure to be used without priming being produced. On one of the trial trips of the *Fox*, she had on board the captain of a new tug-boat about to proceed to China for river service. He was so satisfied of the value of the invention on this ground alone, that he immediately gave orders for the addition of the air apparatus to his engines. It may be noted as a curious fact that the opening of the Suez Canal, by allowing a quicker passage to China, gave time for the alteration to be made without delaying the probable arrival of the boat beyond the period originally fixed for it.

The agitation of the water by the upward passage of the air has also been found in great measure to prevent incrustation of the boilers either by lime or salt. On this point it would at present be premature to speak with any certainty; but there can be little doubt that, at least, a great difference is produced.

We have said enough to show that the invention of Mr. Warsop possesses no small claim to the attention of engineers, and of all employers of steam power. Its value has still to be tested by careful and sufficiently prolonged experiments, conducted by skilled and impartial observers. But for these we shall not have long to wait. Stationary engines of the kind are already in full operation at various places. There is one at the engineering works of Messrs. Robert Daglish & Co., at St. Helens; and another at the shipbuilding yard of Messrs. Wigham Richardson & Co., on the Tyne. A third is in use at the doubling mill of Messrs. Thackeray, of Nottingham. Others are in course of being erected at the works of Messrs. Backhouse & Dixon, of Middlesbrough; Messrs. Kitson, of Leeds; Blair, of Stockton; and Robey, of Lincoln; licenses have been applied for from San Francisco for the use of the patent for portable and traction engines; and it is also about to be applied on engines of 600-horse power at the New York public waterworks. At the works of Messrs. Easton & Amos, Southwark, a Warsop engine of the highest finish is being built and will shortly be open to the inspection of any who may desire to see it. The system has as yet only been made profitably applicable to high-pressure boilers, but the inventor feels assured that he will shortly overcome certain difficulties of detail which have hitherto diminished the economy of its application to condensing engines also. The history of inventions is one of trials, of discouragements; often, also, of ultimate and brilliant success. The Warsop engine may yet be found to have drawbacks that will militate against its usefulness; but, so far as an experience extending over nearly twelve months teaches, such drawbacks are not perceptible. If it should be found to fulfil only half its present promise, it will effect an annual saving the amount of which it would be almost impossible to calculate, and its use would become a matter of necessity wherever the profits of manufacture are curtailed by the influence of competition. No merchant steamer could dispense with it, and, by enabling ships of war to keep the sea, it would become of equal importance to the statesman.—*Times.*

ON MANGANESE AND SOME OF ITS COMPOUNDS.

BY PROFESSOR CHARLES A. JOY.

IN TWO PARTS.—PART II.

IN reference to the applications of the compounds of manganese to the arts, it may be well to mention a few of them in this connection.

Violet Colour.—A very rich violet colour is prepared by fusing finely pulverized pyrolusite and phosphoric acid in proper proportions, digesting in ammonia, filtering, evaporating to dryness, and treating with water; a violet powder remains, called Nuremberg violet.

Green Colour.—Manganese green is the manganate of baryta, and can be represented by the formula $3\,BaO, 2MnO_2$. It possesses a fine green colour, and is much safer than arsenic pigments.

Permanganate of Potash.—This valuable salt can be prepared by passing chlorine gas through a solution of the simple manganate. This is said to be a more economical way for its manufacture than the old methods.

Permanganate of Soda.—This salt is made on a large scale, by heating together 12 parts anhydrous caustic soda, 36 parts soda lye of 1·337 sp. gr., 10 parts chlorate of potash, and 18 parts finely pulverized pyrolusite. This, and the preceding salt, are of great value in chemistry, on account of the fact that they contain oxygen gas in a condition suited to the rapid oxidation of substances; a property that renders them available as disinfectants to destroy all bad odours, to be substituted for ozone in bleaching, and, in general, to be employed as powerful oxidizing agents. The salts are also valuable for the preparation of perfectly pure oxygen.

In Glass.—The use of manganese compounds in glass manufacture is one of the earliest applications of this element; but the fact that glass which has been bleached by it afterwards undergoes a marked change, and in the course of a few months has entirely different optical properties, is not generally known.

The oxide of manganese is put in to counteract the effect of oxides of iron, but, in course of time, the oxide is acted upon by the light and air, and colours the glass red. Many a photographer has been puzzled to know why the glass of his skylight no longer lets light through so as to give him good pictures, and many a gardener has been troubled by the parched appearance of the grape vines in his conservatory, and by the decrease in the yield of grapes; both of these phenomena are due to the fact of the presence of manganese in the glass and the consequent red colour. Red glass will not permit any chemical rays to pass, and hence the photographer can take no pictures. The same colour will let heat through to parch and dry the vines, but the life-giving rays are cut off. Thus, as our knowledge increases, we must order our glass to be made according to the laws of light as well as of chemistry.

Sulphuric Acid.—When water impregnated with sulphurous acid is treated with sulphate of manganese, the sulphurous acid is changed to sulphuric acid. Here is a use of the oxidizing property of a compound of manganese that may offer a way to important manufactures. It works on a small scale, and probably would on a large one, if any one would try it.

Oxygen.—The mineral pyrolusite, or black oxide of manganese, has long been employed to make oxygen, but the recent method of converting it into manganate of soda, and afterwards expelling the oxygen by heat, is less familiar to us. A better method than the manganate of soda is said to be the employment of the corresponding lime salt. By heating lime and binoxide of manganese in a current of air, the manganate of lime is formed, which is less likely to fuse than the soda salt, and hence is more readily made. If the air be passed over the lime for a considerable time, the permanganate of lime

will form, and this bids fair to afford us the permanganates in a ready and cheap way, and also offers a method for isolating pure permanganic acid by decomposing the lime salt with sulphuric acid. By mixing the permanganate with the binoxide of barium, we shall be able to prepare oxygen gas in the cold, by simply pouring an acid upon the salts in a flask, just as we make hydrogen by means of zinc and sulphuric acid.

We have gone far enough in our sketch to show that the applications of manganese are very numerous, and we may recur to the subject again at some future time, particularly as we have said nothing about its most important use in the manufacture of chlorine.—*Scientific American.*

ON THE CULTIVATION OF THE JESUIT'S BARK (CINCHONA) PLANT IN ENGLAND.

BY JOHN ELIOT HOWARD, F.L.S.

SINCE first I had the satisfaction of raising the *C. officinalis* from seed sent me from the mountains of Uritusinga, I have devoted some attention to the cultivation of different species of Cinchona under glass. This has extended over a period of about ten years, during the larger portion of which my experiments have been carried on in a conservatory which I had constructed for the purpose, and which, though on quite a limited scale, enables me to estimate what might be done by means of the appliances at the disposal of the directors of our botanic gardens. I have worked through a fair amount of mistakes and misfortunes, and have now about twenty different forms (species or varieties) of Cinchona in various stages of development; and of these, recently flowering, one plant of the *C. officinalis*,[1] one of the var. *Colorada del Rey*, and one very forward in bud of the (as yet undescribed) *C. Forbesiana*. I have also still in blossom a plant of the *Howardia Caracasensis* about 10 ft. in height, and covered with flowers for the last two or three months. Such a result, if exhibited to the whole pharmaceutical world, as it might be at Kew, could not fail to excite interest, and, moreover, the possession of living plants gives the opportunity of observing many things not apparent in dried specimens.

The facilities thus afforded for physiological investigation are also very important to those who delight to trace the beautiful contrivances and manifest design everywhere apparent in nature, and to whom well-observed facts are more interesting than mere mechanical theories of vegetation. As an instance, I was recently examining, together with a botanist well acquainted with the Cinchonæ in their native woods, some beautiful trebly-scrobiculate leaves of my plants, and we agreed that inspection demonstrated the improbability of a theory recently advanced as regards the scrobiculation, which ascribes its origin to an inherited defect derived from the attacks of insects. The truth being, on the contrary (as I have often observed), that insects are not found to attack this part of the leaf in preference, but are much more addicted to some other portion of the plant. The additional beauty of the leaf derived from the scrobicules and their great regularity must be seen to be appreciated, presenting an appearance quite unlike that of an accidental monstrosity.

As to the light to be thus thrown on botanical arrangement, I may mention the opportunity afforded of raising the seeds proceeding from the same bunch of capsules, and observing thus, as I am doing at the present moment, the amount of variation to be observed in the children of one parent plant.

The very difficulties to be overcome in imitating, as far as possible, the climate and soil of the mountain regions of the Andes, presents many subjects of not unfruitful consideration.

The influence of light upon vegetation will force itself upon the attention in all the varied aspects of the question, as, indeed, presenting some of the most formidable difficulties in the cultivation of plants so sensitive as these are to the deficiency of stimulus in the dreary months of winter, and to the excess both of heat and light in our summer above that to which they have been accustomed. The effect of different coloured rays, of polarized light, of a greater or less amount of actinism necessarily comes into view.

The leaves of many species are particularly sensitive to light, and turn towards the rays of the sun in a manner sufficiently remarkable. In some kinds the structure and colouring are very beautiful, and would quite repay cultivation with this object in view. They are frequently covered with a lustrous epiderm, as described by Dr. Weddell, in reference to the Calisaya. This epiderm seems, as in the case of some other plants, largely composed of wax; when this is removed, either by mechanical injury or by chemical solvents, the leaf suffers, and the oxidation of the juices becomes manifest. It is not easy to imagine from dried specimens, the great variety of structure and characteristic peculiarities which the leaves present; but when once well observed, the aspect of the plant fixes itself in the memory.

The respiration of plants, as affected by a too retentive soil or by too abundant application of water to the roots, has to be studied, and it is also necessary to mark the period of hybernation or repose, and to encourage rather than to interfere with rest at this period—a period which seems in India to be very accurately marked, and which even under glass, it is not difficult to trace.

Then the nutrition of the plants will require much care. It may, at first sight, seem requisite simply to provide the needed soil; and very pure sand, such as Reigate sand, rich loam, and bog earth, in proportions varying according to the species—when mixed, as I find desirable, with broken brick—will sufficiently afford this. But there is more than this; for we shall find, if we study the plant, that it is desirable to supply it at the period of its most active vegetation with food ministered, as much as possible, in a liquid form, and therefore more easily assimilated. For as regards the life and growth of the plant, we may, in a certain sense, adopt the saying of Thales, that "all things are from water," for all things must be in solution (either aqueous or aërial) before they can be changed into the living substance of the vegetable. Now, the natural solvent is rain as it falls from the clouds, and in the normal state (as observed by Weddell and Markham) of the Cinchonæ,[2] the roots spread superficially through a loose mass of earth and decaying vegetation, amidst which they absorb, together with the rain-water, various mineral substances, and also gases, especially carbonic acid, presented to the spongioles in the manner most to their advantage.

Mr. H. Struve[3] has recently demonstrated the existence, under certain conditions, of nitrate of ammonia, together with ozone and oxygenated water in rain and snow; and M. Deville has found in snow and rain, collected in the neighbourhood of the hospice of St. Bernard, a similar composition, at least in so far as nitric acid and ammonia being present in greater or less quantities. I learn from Dr. Anderson that some species of Cinchona flourish at Darjecling, although the rainfall averages 127·30 in. for the year,[4] of which 82 in. fall in three months of the summer. But then the character of the soil and slope of the hills is such that the rainwater, after having bathed the roots, passes away immediately from them; for Dr. Anderson, as every one else, finds the Cinchonæ to be most impatient of water at the roots.

[1] This plant was cut down, and the produce of sulph. quinine which I derived from it is recorded in my *Quinology of the East Indian Plantations*, p. 3. It is now again grown up to a height of 8 ft. 6 in. Mr. Broughton has recently found in five exceptionally fine trees, descendants of the sister of the above, 6·20 of purified alkaloids per cent.

Or sulphate of quinine (obtained crystallised) 3·46 per cent.
sulphate of cinchonidin „ 1·94 „
Also cinchonine.

[2] The *C. succirubra* prefers a stronger soil, and, perhaps on this account, is more easy to cultivate than some others.

[3] *Journal de Pharmacie et de Chimie*, November, 1869, p. 357.

[4] Beardmore, *Manual of Hydrology*, p. 330.

This is difficult to imitate, and the change consequent on the scarcity of rainwater to that derived from springs has (apparently) cost me the health of some valuable plants. Then, again, as the leaves can form chlorophyll only in sunshine, and can only *then* derive nourishment from the air, it must be remembered that, in dark and gloomy weather, we must supply less water and less nourishment to the roots, or the harmony of nature will be destroyed, and the consequences may be fatal. From the same consideration it will follow that too much artificial warmth in the night season will be injurious; and, indeed, the plants never seem to thrive better than when a considerable range of temperature between day and night is allowed to exist. I have found great practical benefit from adopting the system of *double glazing*, leaving a stratum of air about 4 in. in thickness between the sheets of glass. This tends greatly to prevent sudden chills, which are injurious, and also to retain a larger amount of moisture in the air surrounding the plants. This is much required and best secured by syringing the leaves with tepid water twice in the day, avoiding the collection of water around the roots. It is important to provide well for their drainage by means of broken bricks or tiles; and I find an advantage in conducting the warm water of the return pipes below the level surface of the ground, so as to secure a slight and constant elevation of the temperature. I have a thermometer plunged 18 in. in the bed of earth in which my largest plants grow, and I have not noticed this below 50° F. in winter. I think that the proper range of temperature might be placed at from 55° F. in winter to 65° in summer.

It is very important to allow as much access of fresh air as possible. It must be remembered that these are mountain plants, loving free air and alternate mist and sunshine, whilst the hot, close atmosphere of the lower valleys is always injurious to their perfection as quinine-producing plants, and generally fatal to their growth.[5] The very condition of *life* depends on the constituent molecules of an organized body being never all in repose; and whilst these are, on the one hand, received from without, on the other hand effete particles are continually expelled from the plant, whilst others are deposited in the formed tissues, thus building up gradually the solid portions of the structure. In this manner plants live, grow, and multiply under the influence of the vital force; and if these phenomena were more constantly under the notice of our witers on Nature, we should perhaps be able nationally to elaborate something better than mechanical theories of life, forced upon our acceptance with an amount of confidence bearing an inverse ratio to the proofs produced. We should, perhaps, not be told that "there is no real difference between vital and physical forces." Even the theory of cell-formation as the origin of all living things, though true as to the manner in which Nature works, yet does not elucidate her mysteries. It seems to solve more than it really does explain, for what is the cell but the boundary within which Nature carries on her operations?[6] and, after all, what are these? and what is life? Whoever watches the manner in which Nature acts the ædile with her cells ("diruit, ædificat, mutat quadrata rotundis") will think little of the cell itself, and much of that which it contains. If I take in my hands a brick, I have a specimen of material by which, through adding brick to brick, the four walls of a house may be constructed; but I should not be able thence to reason out the nature of the stirring active life which those boundary walls might contain. The addition of brick to brick might very well illustrate the phenomena of crystallization, but the activities of life within the plant much more resemble the course of reconstruction of a great city like Paris, in which an imperial will, availing itself of the all-arranging genius of a subordinate functionary, acts for the good of the whole, and, caring little for the four walls, or for any number of them, if standing in the way of its well-devised projects, adapts the materials even of previous structures to the exigencies of the new thing that has to be produced; and who will deny that the result is admirable?

It is thus that practical experience in cultivation leads to the review of theories which must be cast aside when they have served their turn, or demolished when they stand in the way of real *science*, which means *knowledge*, and not *speculation*.

In the address of the President I observe with pleasure the remark that "a country stroll of half an hour will yield material for thought and investigation available for many a day;" and may we not extend the application of the lines which he has quoted to the more difficult, but not less remunerative, objects of study presented by the cultivation of plants in circumstances so different to those of their native habitat? The very difficulties we encounter are a source of pleasure in overcoming them, and enable us to appreciate more fully that infinitely varied wisdom which has appointed everything beautiful in its season, and all things in measure, number, and weight. *Ne quid nimis* is a golden rule for every one who attempts to cultivate the Cinchonæ under glass. To neglect this would be to insure failure in the undertaking.—*Pharmaceutical Journal.*

[5] I have recently had the opportunity of observing the same result as produced by similar causes in India. Two specimens of red bark were sent over for analysis from Balmadies, a Cinchona plantation belonging to Mr. Rohde. One of these presented the usual appearance of East Indian *succirubra* bark. Mr. Broughton informs me that it was grown in a valley adjoining the Neilgherries, at an elevation of about 4,000 ft. Mr. B. made an examination of it. Though actually lower in elevation than the site of the lower Crown barks on the Nadiwuttum plantations, which produce much cinchonidine, it is tolerably rich in quinine. "The climate differs from these latter by this peculiarity, that during the dry season fogs and mist roll up each day from the western coast and moisten the leaves, and *shade* them from the baking Indian sun." The other specimen had the aspect of the *C. rubra dura* of the Germans, and contained less quinine, but more than twice as much cinchonidine. It came "from the hot bottom of the valley."

[6] See *Chemismus der Pflanzenzelle.* Von Dr. H. Karsten. Wien, 1869, pp. 5, 6, &c.

ON THE EMPLOYMENT OF HŒMATOXYLINE IN PHOTOGRAPHY.

BY DR. C. TABENSKY.

As Erdmann and Hesse have already made known, hœmatoxyline possesses the capability of reducing silver salts, and of colouring them red in sunlight; and inasmuch as Professor Von Babo hereupon expressed his opinion that this compound might find an application in photography, a few experiments in this direction have been made in the laboratory by the present writer.

The hœmatoxyline was prepared in the way described by Erdmann, viz., by leaving the commercial extract of logwood—previously mixed with quartz-sand, to prevent agglomeration—in contact with five or six times its volume of ether for several days, agitating from time to time; then decanting the brownish-yellowish solution, distilling off the ether, mixing the syrupy residue with water, and leaving it to itself in a loosely covered vessel. If no water were added, the liquid would simply dry up to a gummy mass; but if a sufficient quantity of water is present, the hœmatoxyline crystallizes in the course of a few days. The crystals are washed with water, and freed from adhering mother liquor by pressure between filtering-paper. The crystals dissolve slowly in cold water, but easily in alcohol and ether.

The hœmatoxyline was purified by repeated recrystallization in alcohol; and, finally, by the addition of a few drops of acid sulphate of soda. Two plates were prepared in identically the same manner, and exposed to light, and then one of them treated with pyrogallic acid, and the other with hœmatoxyline solution. In the latter instance, the picture was quite as clearly and vigorously developed as in the former, thus showing that the hœmatoxyline may be employed in photography with advantage. The formula adopted by the writer was as follows:—

Hœmatoxyline	...	...	1 part
Distilled water	...	...	160 parts
Acetic acid (of 33° strength)	...		44 „

The addition of a small quantity of glycerine proved advantageous.—*Photographic News, from the Zeitschrift für Chemie.*

WHITWORTH SYSTEM OF GUNNERY.

IT is well known that the French have been trying the Whitworth guns, and have become convinced they have none so powerful. The Russians are investigating them, and the Turks are employing Messrs. Whitworth & Company to prepare tools for new artillery. It would be deplorable if, in case of war, the enemies of England used these guns, whilst the country which produced them had them not. To avert such a result, it is desirable to awaken a general public interest in the subject, and especially to invite the attention of real scientific authorities to the present state which the Whitworth system has reached.

At the last meeting of the British Association at Exeter, Sir Joseph Whitworth read the following paper "On the Penetration of Armour Plates with Long Shells of large capacity fired obliquely," which provoked a lively discussion, and deserves grave attention :—

At the meeting of the British Association, at Norwich, last year, I contributed a paper to this section on "The Proper Form of Projectiles for Penetrating through Water." This paper was illustrated by diagrams, showing the effect produced on an iron plate immersed in a tank of water, by projectiles with flat, hemispherical, and pointed heads. Copies of those diagrams are now before you. In that paper I claimed for the flat-pointed form of projectile, made of any metal, three points of superiority over the ogival-pointed projectiles adopted in the service :—(1) Its power of penetrating armour plates, even when striking at extreme angles; (2) its large internal capacity for bursting charges when constructed as a shell; (3) its capability of passing undeflected through water, and of penetrating iron armour below the water-line. This latter feature was, I think, satisfactorily proved by the experiments described last year, and I desire to draw the attention of the section to the experiments I have made for illustrating the penetrative power of long projectiles with the flat front, fired at extreme angles against iron plates.

These experiments are illustrated by the projectiles actually fired, and the plates they penetrated, which are laid on the table, and also by the diagrams before you. (See p. 146.)

The gun from which the projectiles were fired is called a 3-pounder, though capable of firing much heavier projectiles. It weighs 315 lb., and the maximum diameter of its bore is 1·85 in. The charge of powder used, in all cases, was 10 oz., and the weight of the 6-diameter projectile is 6 lb.

No. 1 is a portion of a plate 2 in. thick, penetrated by the 6-diameter flat-fronted projectile No. 1, at an angle of 35°. No. 2 is a similar piece of plate, 1·7 in. thick, completely traversed at an angle of 45° by the flat-fronted projectile No. 2, which buried itself to a depth of 30 in. in a backing of iron borings. No. 3 is a piece of plate 1·75 in. thick, penetrated at an angle of 65° by the flat-pointed projectile No. 3. No. 4 is a plate 1·7 in. thick, nearly penetrated, at an angle of 45°, by the 3½-diameter flat-fronted projectile No. 4. No. 5 is a plate 1½ in. thick, against which the ogival-pointed projectile No. 5 was fired at an angle of 45°; the projectile failed to penetrate the plate, being deflected in consequence of the pointed form of the head. The distortion of its shape shows the force with which it struck the plate, and proves the good quality of the material which could resist such a test. No. 6 is a plate also 1½ in. thick, against which an ogival-pointed projectile, of the service proportions, viz., 2¼ diameters long, made of Pontypool white iron, has been fired; the projectile has scooped out a furrow 4 in. long and 7·10 in. deep; it broke up into fragments, of which forty-eight were recovered.

The plates Nos. 1 and 3 were purposely thicker than the projectiles could quite pass through, in order that the "work" of the projectiles might be as severe as possible. An examination of the projectiles themselves will show how well they have stood the severe strain to which they have been subjected. The data thus obtained fully establish, I think, the superiority I claimed for the flat-fronted projectiles made of my metal, and satisfactorily prove :—(1) That the flat-fronted form is capable of piercing armour-plates at extreme angles; (2) that the quality of the material of the shells enables their length to be increased, without any risk of their breaking up on impact, and materially augments their bursting charge as shells; (3) that this increase in length, while adding to the efficiency of the projectile as a shell, in no way diminishes, but, on the contrary, proportionally improves, its penetrative power; (4) that the amount of rotation I have adopted in my system of rifling is sufficient to insure the long projectiles striking "end on," and consequently to accumulate the whole effect of the mass on the reduced area of the flat front.

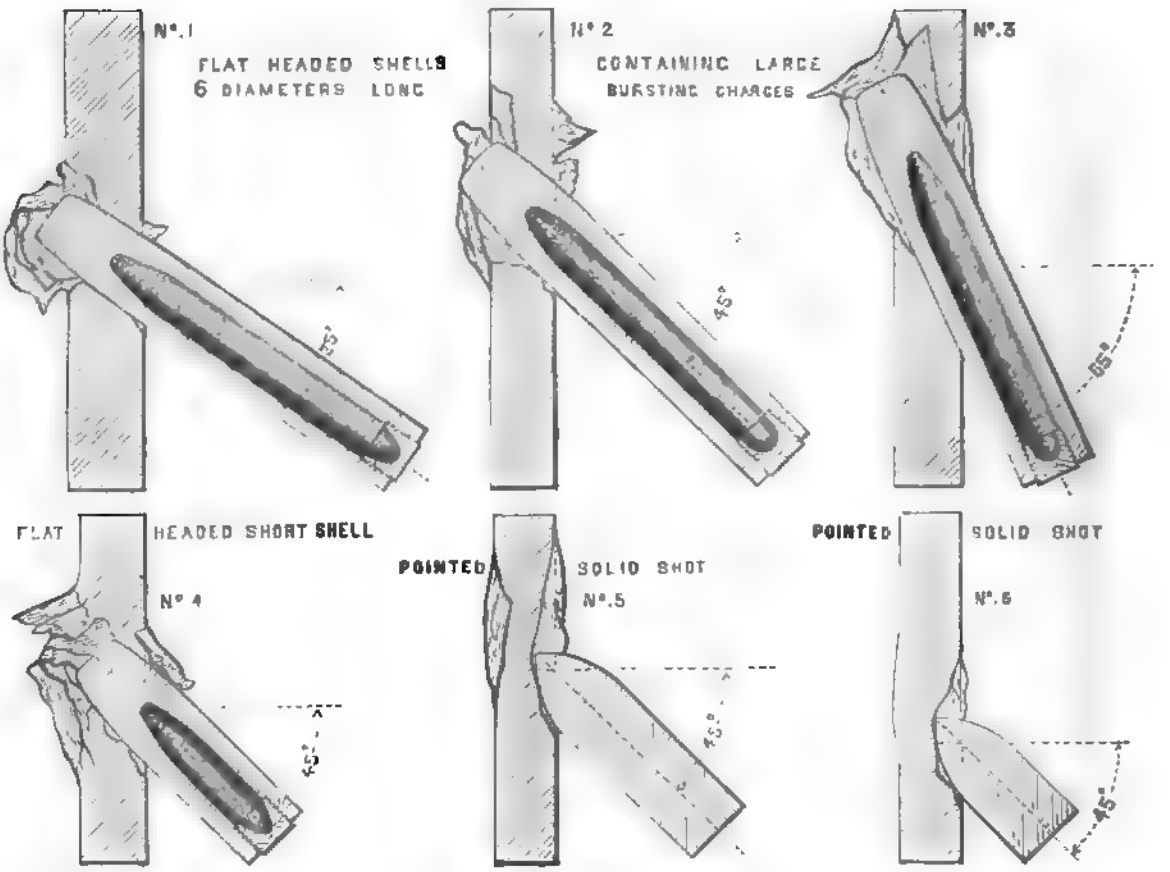
These experiments show, further, that the ogival-pointed projectile has but small power of penetration when striking at an angle, solely on account of the form of the head; a projectile of "Whitworth" metal, with the like ogival-pointed head as a service projectile, having resisted the shock of impact without breaking up, but being deflected in precisely the same manner as the pointed service projectile, which was shivered into fragments. The objections I made in my paper last year to the ogival-pointed projectile—(1) That its form of head causes it to glance off from plane or convex surfaces when hitting diagonally; and (2) that the brittleness of its material renders it liable to break up on impact—I have now proved to the section. The facts illustrated by these experiments are not of recent discovery. Ever since 1858 I have constantly been advocating the flat front. I have on the table a small plate ⅛ in. thick, experimented upon in 1862 with hardened steel bullets, fired from my small-bore rifle. No. 39 is the hole made by a flat-fronted bullet, which has penetrated the plate at an angle of 45°; No. 40 is the indent of a hemispherical-headed, and No. 41, of an ordinary round-nosed bullet, both fired at the same angle of 45°. These three rounds were fired in 1862.

Within the last few days I have had an ogival-pointed shaped bullet fired at the same plate at the same angle, in order to confirm the effect with that produced on a larger scale on the plate No. 6. It is interesting to observe how closely the results obtained with the small calibre of my rifle agree with those of the 3-pounder gun which form the subject of this paper. Those experiments recorded in the paper were made with a gun of smaller calibre, from considerations of economy and convenience; but I have always found that what I could do with the smaller calibres of my system, could be reproduced in the larger sizes; and, from my past experience, I feel warranted in asserting that the effect of penetration now exhibited could be repeated on a proportionate scale with my 9 in. guns at Shoeburyness, or with the 11 in. guns my firm are now engaged in constructing.

A glance at the formidable nature of the projectiles thrown by these guns, and a consideration of the effects they may be expected to produce, will show the importance attaching to the question of penetration of plates by long projectiles. The 9 in. guns to which I have referred weigh 15 tons each, and are capable of firing powder charges of 50 lb. A 9-in. armour-shell, 5 diameters long, weighs 535 lb., and will contain a bursting charge of 25 lb.

I have no hesitation in saying that these projectiles would pierce the side of a ship, plated with heavy armour, at a distance of 2,000 yards, and at some depth below the water-line. The 11-in. guns will weigh 27 tons, and will be capable of firing 90 lb. powder charges. The 11-in. shells, 5 diameters long, will weigh 965 lb., and will contain bursting charges of 45 lb., and would pierce the side of the ship *Hercules*, plated with 9-in. armour at a distance of 2,000 yards.

Were it not that the increased destructiveness of war must tend to shorten its duration and diminish its frequency, thus saving human life, the invention of such projectiles could hardly be justified; but believing in the really pacific influences of the most powerful means of defence, I call these long projectiles the "anti-war" shell. The principle I have



THE WHITWORTH SYSTEM OF GUNNERY.

always insisted upon and laid down, for my own guidance in artillery experiments—when either a low trajectory or penetration is required—is, "that every gun should be in strength capable of withstanding the largest charge of powder that can be profitably consumed in its bore." I have drawn up the accompanying table of the sizes of the bores of my guns, with their proportionate powder charges, and the guns will all be fully equal to this duty, and I believe the greatest possible effect from the consumption of a given quantity of powder will be obtained. But the guns adopted in our naval service are not equal to such a test; nor, as I believe, are they so proportioned as to realize the best effect from the quantity of powder they consume.

Four guns of 12-in. bore have lately been put on board the *Monarch*. They weigh 25 tons each, and charges of 50 lb. and 67 lb. have been fired from them, with projectiles of 600 lb. weight. I have no doubt that these guns have been made with all possible care, and are as strong as their material and construction admit; but if the weight of these guns were in proportion to the capacity of their bore, and if the material were the best that our metallurgical skill could supply for such a purpose, they ought to fire 117 lb. of powder, and projectiles of 1,250 lb. weight. They would then be efficient weapons; but at present they are more formidable in name than in reality.

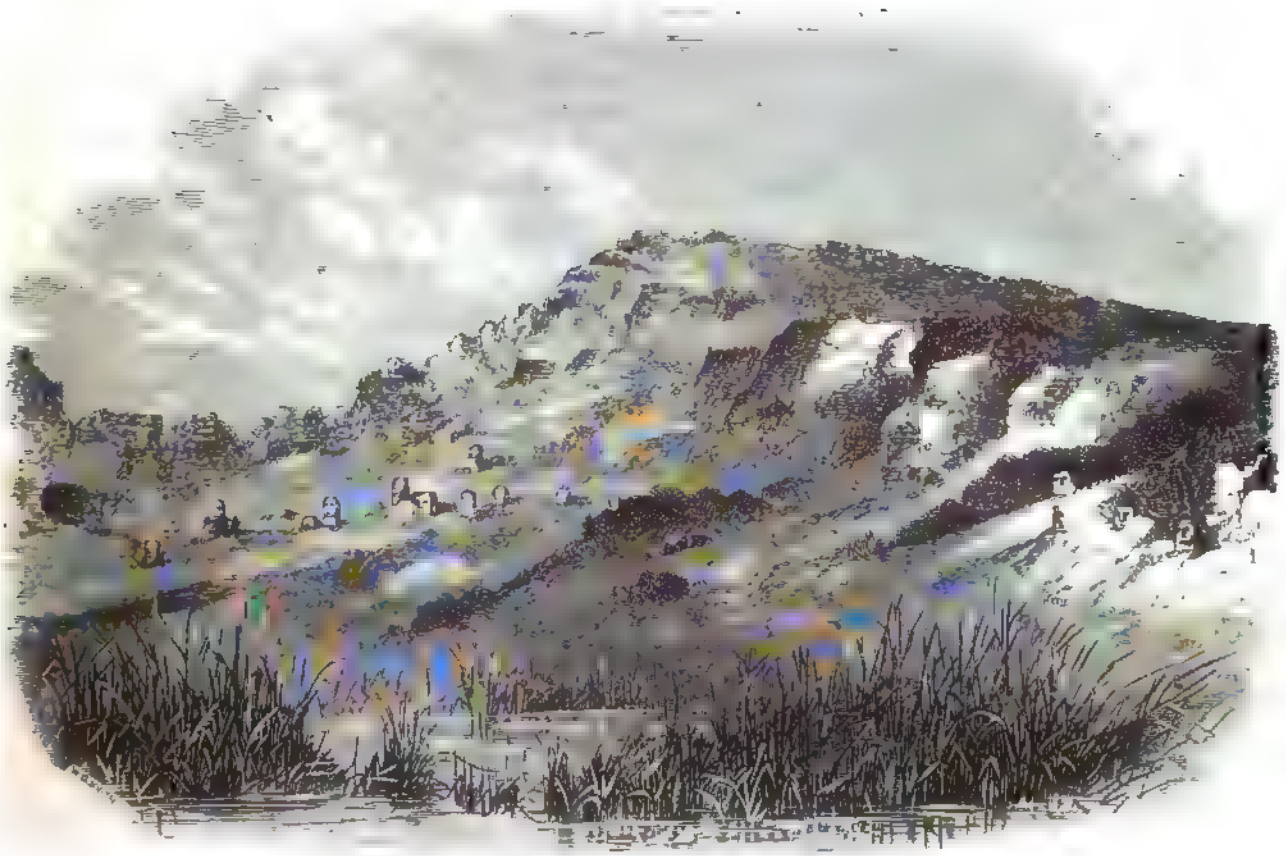
We are often flattered by being told that we have the best guns in the world. That may or may not be the case. But I think that we should not rest contented while we are still so far from having attained as much as our present advancement in mechanical and metallurgical science has rendered possible for us.

PARTICULARS OF AMMUNITION FOR WHITWORTH GUNS, FROM 5·5 in. TO 13 in. BORE.

Calibre of bore.	Powder charge.	Common shells, cast iron, 3·5 diameters long.		Armour shells, Whitworth metal, 5 diameters long.	
		Bursting charge.	Weight of shell.	Bursting charge.	Weight of shell.
in.	lb.	lb.	lb.	lb.	lb.
5·5	11·0	4·0	70	6·0	120
7·0	23·0	8·5	150	12·0	255
8·0	34·0	13·0	220	18·0	375
9·0	50·0	18·0	320	25·0	535
10·0	70·0	24·0	440	35·0	740
11·0	90·0	32·0	580	45·0	965
12·0	117·0	40·0	750	58·0	1,250
13·0	150·0	51·0	960	75·0	1,615

Mr. Whitworth's patent cartridge increases the range from 15 to 20 per cent.—*Journal of the Society of Arts.*

A NEW photographic society has just been formed in Berlin. It will publish a monthly journal, *Helios*, under the editorship of its president, Herr Krone.



THE SCULPTURED IMAGES IN EASTER ISLAND.

THE STATUES OF EASTER ISLAND.[1]

THE account of Easter Island and its statues, as lately told in our pages by Mr. Martin Tupper, in consequence of the arrival in this country of some of the figures, has scarcely excited so much attention out of doors as it properly calls for. The facts are so remarkable, and the mystery surrounding them so great, that we are prompted to place before our readers all the materials available for forming a judgment on the points in question. By the kindness of Lieut. Harrison, we are enabled to give a sketch plan of the island, a view of part of it, with its marvellous grove of gigantic heads, and a representation of one of the recumbent figures, with the singular tufa crown, to which reference has before been made. To these we add representations, back and front, of the two figures brought from the island, and now in the British Museum.

Contemplate the broad fact for an instant. Here on this barren island, not thirty miles round, in the midst of the vast Pacific Ocean—an island, treeless, metalless, and foodless, occupied by a few wretched savages, and 2,500 miles from its nearest continental neighbour,—more than 300 of these stone statues, 20 ft., 30 ft., and in one case at least 50 ft. high, some of them standing on long platforms of Cyclopean masonry, have been counted, and how many more there may be in the interior is not known to us. When and by whom were they made? The people now inhabiting the island know nothing of their origin or purpose, and take no interest in them: they have no tradition even of the extinct people by whom they were raised. Transported from other lands, as things now are, they could not have been. Is there any other mode of explaining their existence than by the belief that Polynesia was once a continent,—a submerged continent and an extinct people?—that we have here another—

> "Lyonnesse,
> A land of old upheaven from the abyss
> By fire, to sink into the abyss again;
> Where fragments of forgotten peoples dwelt."
>
> *Tennyson.*

A submergence of vast tracts of land similar to that suggested with reference to Easter Island probably took place in the Atlantic. Scholars will remember the tradition in Plato's dialogue, entitled *Timæus*, making direct mention of a great Island of Atlantis, situated beyond the pillars of Hercules. On this extensive Atlantic island there was a powerful kingdom. In an evil day, he writes, this island sank into the ocean. Professor Unger, of Vienna, in a valuable lecture on this sunken island of Atlantis, of which a translation is published in the *Journal of Botany*, gives very interesting evidence in favour of this tradition from the flora and fauna, and in support of the theory that, "in the Tertiary period, or when lignite was formed, Europe must have been connected with North America, and the Atlantic ocean must have been divided at one place or another by a continent." The continental connection of Australia and Europe during the Eocene period is argued for.

No metal nor even flint is found on Easter Island, but only some hard stones, capable of being fashioned into so-called celts. Were these figures produced with such instruments?

[1] For the use of the block of this illustration we are indebted to the Editor of the *Builder*.

The workmanship is rude, but not bad. Some description of those in the British Museum, and now illustrated by us, we have already given, and need not repeat it. Observe the excellent conventional treatment of the arm and hand, and of the jaw and chest in the larger figure. The ears (if they are ears) are very peculiar. The carving on the back of the smaller figure, tufa, is very remarkable; the band in the larger figure is clasped in the two hands. The receding forehead and projecting mouth are very striking. The tufa crowns are also singular, and are in many cases 6 ft. high, and 5 ft. in diameter. These must have been placed on the top of the statues after their erection,—not an easy task. . . . .

It does not seem certain that we may claim for these figures a very high antiquity: they are very Mexican in appearance, and their age may be not greater than that of the ruined cities of Central America, of which we know. The submergence might have taken place in the Middle Ages, without any intimation of the momentous occurrence reaching us. They may, however, be very much older. Anyhow they represent a most extraordinary phenomenon, and present very curious questions for consideration. We can recall nothing more remarkable than the view we now give of part of the island, with its growth of statues.—*Builder.*

REVIEWS OF BOOKS.

Qualitative Chemical Analysis. By Dr. C. Remigius Fresenius. Seventh Edition. Edited by Arthur Vacher. London: John Churchill & Sons. 1870.

Quantitative Chemical Analysis. By Dr. C. Remigius Fresenius. Fifth Edition. Edited by Arthur Vacher. London: John Churchill & Sons. 1870.

We doubt very much that an English chemist will be found in the present state of things who can write a work on chemical analysis equalling, both in exactness and minuteness of detail and in the originality of its contents, that which can be written by a German. At least in Germany we find chemists who are both able and willing to devote a lifetime to the developing and perfecting processes for the detection and quantitative estimation of substances, and are not very likely to find such men in England. We are led to express this opinion by having before us the new English editions of the two volumes of Fresenius on *Chemical Analysis.* The Wiesbaden professor is a pre-eminent instance of one who has devoted a lifetime to the object we have indicated. He has raised in these works monuments to the vast assistance he has afforded to other chemists in their labours, which will remain long after him, but which can never bring him that renown that an equal application of his abilities and time to other branches of his science would have done.

The treatises on Qualitative and Quantitative Analysis by Fresenius have for a great number of years been familiar to English students and teachers of chemistry in the excellent translations of Mr. Lloyd Bullock. They are now given to us by the hands of Mr. Arthur Vacher, who has not merely reproduced the substance of them, but has freely availed himself of his editorial capacity to make such modifications as he deemed improvements in them.

We cannot epitomize more briefly than the editor has done the differences between the sixth edition of the *Qualitative Analysis* and the seventh:—

"Several improvements, necessitated by the progress of discovery, have been introduced by the author; and I have specially striven to meet the wants of English students. The language has been condensed, the notation and nomenclature have been modernized, the arrangement has been simplified. The consideration of rare inorganic bodies and of organic bodies has been deferred to the latter part of the volume, where a section has been devoted to each. The grouping of the metals has been harmonized with the course of analysis. The course of analysis has been simplified in description, and the preliminary examination has been curtailed. Analytical tables have been added at the end, which include the preliminary examination and the detection of metals in soluble mixtures."

The improvement is material in the arrangement for the analysis of mixtures of salts, most of the tiresome references to other pages having been avoided.

The section on the detection of the alkaloids continues to be an extremely valuable part of the work.

Turning now to the Quantitative Analysis, we find that Mr. Vacher has been very busy indeed with the pruning knife. He has, in fact, cut it down in the fifth edition to half what it was in the fourth edition. This act has our entire disapproval. A treatise on quantitative analysis, if well arranged and composed of processes tested by its author—and such is that of Fresenius—cannot be too full in its details. It is not intended for systematic study, except at the laboratory bench, and there every suggestion for the accurate execution of a chemical operation is welcome, and likely to save the disappointment of getting unsatisfactory results after the performance of tedious operations. Mr. Vacher has omitted many quantitative methods and innumerable reminders and precautions in the execution of those retained, and in doing so he has greatly lessened the value of the work. If, however, we suffer by his editorial zeal in one direction, we gain in another; and in what we have presented to us in the present edition, the improvements and additions are not few. We trust that in the sixth edition we shall see a tendency to restoration and preservation of what is good in the experience of chemists, rather than one of elimination and destruction. We would also ask for a return to the much more convenient page headings in the previous editions of both the Qualitative and Quantitative treatises; and further, for more detailed "contents" and indexes.

Notes for Students in Chemistry; being a Syllabus of Chemistry and Practical Chemistry. Compiled from the Manuals of Gmelin, Miller, Fownes, Berzelius, Naquet, Gerhardt, Gorup-Besanez, &c. By Albert J. Bernays, Ph.D., F.C.S., Professor of Chemistry and Practical Chemistry at St. Thomas's Hospital. Fifth Edition. London: John Churchill & Sons. 1870.

Professor Bernays has performed for one in his position a very humble labour. He has compiled a note-book for students, from the "manuals" issued by other chemists in similar professional positions to himself. For our own part, we wish he had spent the time he must have devoted to this labour to something more beneficial to the interests of the science he professes, and more serviceable to the student. Some persons believe in the usefulness of such a book as this, as rendering note-taking by the student unnecessary. With these we cannot agree. Few would say that a student could learn chemistry from such notes alone: to be useful, it is admitted they must be read in connection with attendance on a course of lectures, or at least with the reading of fully written works on the subject. But when thus used even, we are more than sceptical as to their utility. To acquire anything more than a verbal knowledge of his subject, the student must go through the mental process of taking notes as he goes along, whether he commits them to paper or not. He must *think* as he listens or reads, and form conceptions, and follow out trains of reasoning. In doing this, he takes notes, and to supplement the imperfections of memory, it is well for him to write them down as he takes them. No one can think for him, and therefore, in our opinion, no one can take notes for him. Teachers, and text-book writers, can assist his studies immensely, by furnishing him with a methodical summary of the leading facts and doctrines of the science, but then these summaries must be clearly and fully written, and complete in themselves. Such assistance *Notes for Students* cannot afford. At least we think so, and for the

reason we have stated. For the information of those who think otherwise, we must, however, say something as to the merits of this little note-book as such. It is a very full compilation, and exhibits evidence of both the industry and the care of the writer. The fifth edition is a great improvement of the fourth. The new notation and nomenclature are now exclusively used. We notice additional notes in apparently every paragraph in the book, and a close revision of the whole. The matter has been subtracted from as well as added to, but still the work is considerably enlarged. We have said that the author has performed a very humble labour; we will now add, that he has done it without ostentation, for though he has made such numerous emendations and additions in this edition he makes no mention of anything he has done in the preface to it, the first edition, by the way, that he has treated to a preface at all. In conclusion, let us express our conviction that Dr. Bernays has worked earnestly to aid the student, and our hope that his exertions receive a due appreciation from those who are able to benefit by them.

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FRENCH.

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Test for Hardness of Metal.—The hardness of metals, says the *Builder*, may now be ascertained by aid of an instrument invented by a French engineer. It consists of a drill, turned by a machine of a certain and uniform strength. The instrument indicates the number of revolutions made by the drill. From this, compared with the length of bore-hole produced, the hardness of the metal is estimated. It is said that a great proportion of the rails now employed in France are tested by this instrument.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

A Meteorological Phenomenon.—*From* G. Darwin.

Sir,—As I was travelling by rail on Saturday afternoon, at about half-past four, between London-bridge and New Cross stations, my attention was attracted to a very remarkable appearance in the sky. The sun was at the time very near to the horizon and was hidden by a dense wall of clouds, of which it only gilded the upper edge, but it was shining brightly on some light misty clouds, which were floating high aloft between the bank of clouds and me.

On a part of these light clouds I observed a kind of rainbow vertically above the sun, and, as well as I could estimate, distant from 20° to 25° from it. This rainbow consisted of a bright spot, with two streamers issuing from it, which were inclined to each other at about 90°, or a little more, and pointed away from the sun, but were symmetrically arranged with respect to the vertical through the sun. The most accurate description which I can give of the shape is that it formed an equilateral hyperbola, with the convexity towards the sun, and the major axis passing through it.

The bow was broader than the ordinary one, but the edges were very undefined, and, except in the bright spot (*i.e.* the vertex of the hyperbola) the colours were not at all bright. This appearance only lasted for about a quarter of a minute from the time at which my attention was first attracted to it, and I was so intent on observing the form that, although I noticed that the colours were nearly those of the spectrum, and were arranged horizontally at the vertex, and I think ran longitudinally along the streamers, and not transversely across them, I did not notice which end of the spectrum was towards the sun. The appearance died away gradually, but in a faintly coloured spot which appeared about half a minute afterwards I noticed that the red was towards the sun.

The bow occupied about 15° of the heavens from the extremity of one streamer to that of the other. My first impression was that it was possibly part of the tertiary rainbow, which had taken this peculiar form owing to the shape in which the falling drops happened to be arranged; but in that case the colours must have been placed transversely on the streamers, and I think that an appearance so remarkable would have infallibly caught my attention. I conclude, however, from the account in Young's *Natural Philosophy*, vol. i. p. 443, of coloured halos seen in northern latitudes, that this appearance must have been a part of a system of halos. In fig. 431, pl. xxix. there is a picture of one of these systems, and part of this somewhat resembles what I saw.

As I have never come across any one who had seen such a thing, I suppose that such phenomena are rare in these latitudes. I send you this account thinking that it may be interesting to your readers.

Your obedient servant,

Down, Beckenham, Feb. 7. George Darwin.

Aurora Borealis.—*From* Thos. G. Elger *and* John J. Hall.

Sir,—On the evening of the 1st inst. another very remarkable aurora was observed here. The first indication of anything unusual in the appearance of the sky was noticed shortly after 7, when a phosphorescent white band, about 6° in breadth, could be traced from the horizon in the E.N.E., through θ Ursæ majoris and Cassiopeia, towards the west. It was at first only faintly luminous, but rapidly increased in brightness, and spanned the sky from horizon to horizon; it then assumed the curtain-like aspect so frequently remarked during auroral displays in Northern Scandinavia, but which, I believe, is rarely observed in this country; at times it appeared to consist of well-defined bars of light parallel to each other, and directed towards the northern horizon. This band gradually died away, but was soon followed by others of a similar character; at 7.43 a fine belt of light passed through Aries and the square of Pegasus to the western horizon: it changed its form very rapidly, became contorted, and drifted towards the south.

Fainter bands were observed at intervals until 9. No appearance of auroral light above the northern horizon was noticed till about 7.30, when a glow was seen which gradually deepened and remained visible till nearly 10.

Between 8 and 9 I examined the light of this glow with the spectroscope, and saw one broad and tolerably bright line in the yellow, and very faint traces of light towards the more refrangible end of the spectrum. I am, Sir, your obedient servant,

Bedford, Feb. 4. Thos. G. Elger.

SIR,—A very beautiful aurora was observed here on the evening of Tuesday, the 1st inst., although by no means fully developed during my observation, and of comparatively short duration. From estimation I should say its position was from 25° to 30° south of the zenith, stretching for a considerable distance from E. to W. I am informed by a friend at the Kew Observatory (Richmond), that the photographic trace from the self-recording magnetograph showed considerable agitation of the magnetic needle. Your obedient servant,

St. Mary's Grove, Richmond, Surrey, Feb. 7. JOHN J. HALL.

THE CHAIR OF BOTANY IN THE ROYAL COLLEGE OF SCIENCE, DUBLIN.

SIR,—As the investigation of science is necessarily the pursuit of truth, you will be glad to have the following corrections and annotations on your article on the above subject in the last number of your journal.

1. The Chair of Botany in the College of Science has a yearly endowment of £200.

2. You correctly give the history of the recent appointments. Both chairs held by Dr. Dickson became vacant on his succeeding Professor Walker-Arnott at Glasgow. The vacancy first filled up was that at Stephen's Green, by the appointment of Professor Wyville Thompson by the authorities at Kensington. Some time after, when the Board of Trinity College proceeded to fill up their vacancy, they appointed a distinguished alumnus of their own college, and rejected the occupier of the Stephen's Green chair. Thereupon Professor Thompson re turned to his chair at Belfast, which he had not resigned, and gave up his appointment at Dublin. The South Kensington authorities, in dealing with the vacancy thus created, confirmed the action of the Board of Trinity College in separating the chairs. It is thus obvious that your complaint should be directed against the authorities in Dublin, and not those in London. I have no doubt that the electors of Trinity College can defend their action; and indeed it is obvious that there is room for considerable difference of opinion as to the propriety of uniting the chairs.

3. If you recall Mr. Dyer's contributions to botanical science, you will, I am sure, acknowledge him to be a "distinguished," as well as an "industrious" botanist.

He is, with Dr. Trimen, conjoint author of the *Flora of Middlesex*, a work universally acknowledged to be a decided advance on any published County Flora.

With Professor Church, he has edited an American work, *How Crops Grow*; or, rather, he has re-written the Botanical portion of the work, as a comparison of the American and English editions show. This work, as far as its scope permits, contains the most recent and satisfactory exposition of physiological botany to be found in the English language.

He has translated an important memoir, by Miquel, on the Structure of the Seed in Cycadeæ, and has added to the published translation many valuable critical notes.

The smaller notices which he has published equally testify to his ability, and more than justify his appointment to the Chair of Botany in Dublin. I am, &c., F.L.S.

THE BROCKEN OF THE HIMALAYA.

SIR,—A short time ago I learnt that, in a certain part of the Himalaya Chain (I cannot remember the exact name of the district), the phenomenon of the Brocken—the *Brockengespenst*—of the Harz Mountains is repeated with the addition of a halo, or rather a prismatic-coloured ring, completely surrounding the reflected image; and still further, that each individual sees his own reflection, while that of his companions is barely detected. Is not the former fact a singular one? and on what physical conditions can it be satisfactorily explained? With regard to the latter point, I have never heard such to be the case on the Brocken. J. B.

PERIODICITY OF SOLAR SPOTS.—*From* R. A. PROCTOR, B.A., F.R.A.S.

SIR,—I cannot, on account of Mr. Elvins' kind expressions regarding myself, withdraw my protest against the tone of his last communication. In that communication (unwittingly I doubt not) he *did* commit the grave offence against scientific morality of presenting fancies as established facts. I hold the spread of true knowledge to be so important, that I make a rule of commenting in very definite terms of conduct of this sort. I should have done the same even though I had thought his opinions correct. No man has a right to describe opinions in terms applicable only to established facts.

As regards this part of my letter, then, there is nothing I can withdraw. It appears, however, that I was wrong in describing Mr. Elvins' theory as "vague guess-work." It has been "the result of years of patient toil." My excuse must be that no one could have suspected this.

Mr. Elvins' *theory of comets* exhibits such amazing conceptions respecting the laws of motion that I fear I shall hardly convince him of the yet more astounding absurdity of his explanation of the solar-spot period. Let me try, however. Passing over a number of other difficulties, each absolutely insuperable, save by ignoring the most obvious facts, I would ask him *why* the November meteors should drop into the sun. They do not come within 89,000,000 miles of him if they travel in the orbit calculated by Oppolzer for Tempel's comet, nor within 90,000,000 miles of him if Adams's estimate of their orbit is correct. So that they are about as likely to drop into the sun as the earth is—or even less, since they travel far more swiftly past their perihelion than the earth travels in her orbit.

When Mr. Elvins has shown why the November meteors should leave the orbit assigned them by astronomers, in order to leap over the tremendous gap separating their perihelion from the sun, it will be time to dwell on other and equally egregious absurdities in his theory.

Surely the difficulties Mr. Elvins has had to contend against—of which he says I "can form no idea"—can be no other than the powerful array of facts across which he has pushed both his theory of comets and his views as to the cause of the solar-spot period.

Yours faithfully,

Feb. 3. RICHARD A. PROCTOR.

"WHAT ABOUT THE MAMMALIAN JAW?"—*From* T. P. BARKAS, F.G.S.

SIR,—In an editorial note appended to a communication of mine which appears on page 73, vol. iii., SCIENTIFIC OPINION, you remark "If it were not exceeding our task as editor, we would express a hope that Mr. Barkas would prolong his researches on each specimen. He is always telling us of new discoveries, but he seldom tells us of anything completely. What about the mammalian jaw?"

With all deference to your opinion, Mr. Editor, it seems to me that the best course to adopt in bringing before the scientific world a description of discoveries in any department of palæontology is, first, to introduce facts, and then, when facts have become sufficiently numerous, deduce inferences. The greatest error into which any investigator into coal-measure palæontology could fall, would be that of drawing large inferences from very limited premises. The truly Baconian, and only safe method, is, in the first place, to accumulate well-ascertained facts, and, so far as coal-measure fauna are concerned, facts are just the things we most require. That will be evident when we learn that the majority of the fossil specimens obtained from the Northumberland and other coal-measures are obtained in a fragmentary condition, and that nearly all the coal-measure fishes of which we have anything like complete descriptions are Platysomus, Cœlacanthus, Acrolepis, Palæoniscus, Acanthodes, Pygopterus, Amphicentrum, Rhizodopsis, and Megalichthys, and the approximately complete knowledge we have respecting them has been, to a large extent, derived from specimens obtained in the Permian and other strata, rather than from specimens obtained from the true coal-measures.

As an illustration of the incomplete knowledge possessed regarding moderately well-known coal-measure genera, I may state that little, perhaps nothing, is known of the genus Ctenacanthus, except that the fishes possessed curiously-formed spines; of Orthocanthus and Leptacanthus the spines alone are known, and the genera derive their names from the characters of their spines; much obscurity yet rests upon Gyracanthus, a cartilaginous fish, the spines of which are in almost every museum; and whether it had or had not teeth is not yet certainly established. Similar obscurity yet rests upon Pleuracanthus, the spines of which are common in our coal-measures. The teeth of Diplodus are supposed to belong to fishes which possessed the spines of Pleuracanthus, but of that there is no absolute certainty. The teeth of Cladodus are at present ascribed to two very different fishes, Gyracanthus and Ctenacanthus. Of Strepsodus nothing is conclusively known beyond the peculiar character of its teeth.

The forms or character of the fishes which have teeth known as Pœcilodus and Pleurodus are unknown. Climaxodus may be a Ray or a Cestracion, the matter is as yet quite uncertain, as a moderately complete group of the teeth has not yet been found. The teeth known as Ceratodus may probably belong to Ctenodus, the generic distinction being far from established, and recognized facts point in an opposite direction. Ctenoptychius is probably a tooth, but, so far as I am aware, the supposed teeth have never been found *in situ* on the jaw; they vary much in character, some having but five denticulations, and a newly-discovered specimen now before me possesses sixty-six denticular ridges. Upon nearly all the fishes known to belong to the coal period much obscurity prevails, except those on the list first enumerated, and respecting them much information has yet to be

obtained before our knowledge of them can be recognized as approximately complete.

Of the reptiles of the coal period less is known than of the fishes, and to so slight an extent has the investigation of the reptiles of the Carboniferous era been prosecuted that no work on the subject at present exists. The information which has been obtained is scattered throughout various serials; some of the chief museums in the kingdom contain but a limited number of specimens of Palæozoic reptiles, and from other large museums they are entirely absent.

The latter statement is amply verified in the preface to the *Index to the Fossil Remains of Aves, Ornithosauria, and Reptilia contained in the Woodwardian Museum of the University of Cambridge*. The venerable Dr. Sedgwick, on p. vi. of his prefatory notes, says "of palæozoic reptiles we do not possess one single British specimen."

With these facts before us I think you and your readers will probably agree that I have some justification in detailing isolated palæontological facts without basing upon them merely hypothetical inferences, so long as for the most part mere fragments of fishes and reptiles come into my possession.

Hasty generalization is far more reprehensible than is the lower labour of truthfully presenting details, and, besides, the presentation of such details, especially when the specimens described are freely at the service of any palæontologist, will afford investigators in our own or other coalfields, the means of comparing the specimens they find with those that have been found elsewhere, and by such comparison much required information may eventually be obtained.

Taking Strophodus as an illustration, several teeth that have been ascribed to various species of that genus have by the discovery of the complete oral armature of Strophodus been proved to belong to one fish, and what were previously recognized as many species, have had to be discarded from the records of science. You will, I trust, Mr. Editor, now see that it is practically impossible to describe many coal-measure fishes completely, and if I clearly describe the new specimens that are found, I at least increase the knowledge of details upon which the superstructure of true science will have to be built.

You ask "What about the mammalian jaw?"

The mammalian jaw is yet in my possession; it is the only jaw of the kind I have yet found or seen, and I believe it is the only jaw of the kind that has been found or seen. The cabinet of Mr. Ward, of Longton, is rich in jaws of fishes and reptiles, but nothing like the supposed mammal jaw is in his possession; and the same is true of the collections possessed by Messrs. Sim, Taylor, and Campbell, of West Cramlington. The jaws of Acanthodopsis have been referred to as being similar to the unique jaw in my possession, but in reality it bears no resemblance to the jaws of that little understood fish. The upper jaws of Amphicentrum more closely resemble it, but the contrast is so marked that the most casual observer can recognize the difference between them. Whatever the jaw is, it is evidently unlike all that have yet been described, and I believe all that have been discovered. The jaw has been seen by several gentlemen eminent in palæontology, and with one exception they acknowledged that it presents mammalian characteristics. It has not yet been seen by any palæontologist who makes comparative odontology a speciality, but I trust, on an early occasion, to have an opportunity of submitting the specimen to one or more of the best odontologists in the kingdom, and whatever their opinions, whether for or against the conclusions at which I have provisionally arrived respecting the fossil, your readers shall be made acquainted with them. I am merely desirous of ascertaining truth, not of supporting an assumed infallibility, which I neither claim for myself nor am prepared to allow to others.

I am yours obediently,

Newcastle-on-Tyne. T. P. Barkas, F.G.S.

Emasculation in Animals.—*From* Lawson Tait.

Sir,—Would you allow me, through your columns, to request urgently that any one who may be in possession of facts, well authenticated, bearing on this subject will record them? It is scarcely possible to exaggerate the importance of such a fact with regard to many questions now at issue. For instance, what a valuable fact it would be for Darwin!

May I suggest that correspondents give their names and addresses? because, otherwise, their contributions may be altogether valueless.

Wakefield, Feb. 3. I am, &c., Lawson Tait.

Negative Evidence in Geology.

Sir,—Your correspondent "A Young Beginner" has employed his time and opportunities well, and has no doubt read much and carefully. He has forcibly expressed, by ample quotations from recognized authorities, the case of that school of geologists who (unfortunately as I think for the progress of science) have allowed absence of knowledge to take the place of knowledge. All the arguments and opinions adduced by your correspondent were long ago brought forward to prove that the human race was of recent introduction, that mammals and birds were tertiary only, that reptiles did not exist during the palæozoic period, that fishes commenced with the carboniferous series, and that none but animals of low organization lived during the earliest fossiliferous deposit. Each assumption has in turn been disproved by facts, but the old feeling remains: We have, then, not found them; therefore they are not to be found.

Allow me to point out to your correspondent, and to your readers interested in this question, that the space occupied by palæozoic rocks on the present surface of exposed land is exceedingly small in comparison with the earth's surface, and that the localities hitherto examined successfully for fossils bear no large proportion, even to this area. So large a part of the earth's surface is now withdrawn from the possibility of receiving more than accidental indications of the characteristic inhabitants of the land, that if the present land were submerged, and the sea bottom raised into land over the whole earth, the chances of discovering such indications would be infinitely small. The same argument applies to the littoral and shallow water as to those found in deep sea, for these, in most cases, would be almost barren, or would only contain remains of marine organisms. Shores and shallow water are not necessarily connected with inhabited land. The mere fact that we have found in the middle of the Oolites, in one very limited deposit, a few bones of minute quadrupeds, nowhere repeated in the vast and rich areas of secondary fossiliferous rock, is of itself proof of the rarity of the conservation of such fossils. No rock is more promising in this respect than the Stonesfield slate. We know that the conditions were in the highest degree favourable for receiving and retaining remains of land animals: we know that such animals were present not far off. And yet no bone of mammal, and only one fragment of a warm-blooded animal of any kind, has been found in them.

In spite, then, of high authority, and in opposition to the craving for generalization, so natural and so useful in its way, I hold that it is more logical and more philosophical to be cautious and wait for facts, than draw conclusions from ignorance. I neither affirm nor deny that the Eozoön was the first animal, and the Lower Laurentian rocks the first fossiliferous deposits; but I do say that, on the one hand, I am a little ashamed of the number of *protos* and *eos* and *palæos* that I find in geological nomenclature; and that, on the other hand, an admission of there being still something more to be learnt about the earth's early history is one that none of us need be ashamed of.

An Old Stager.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

Thursday, January 27th.—The following paper was read:—"Observations on, the Temperature of the Strata taken during the sinking of the Rose Bridge Colliery, Wigan, Lancashire, 1868–69," by Edward Hull, M.A., F.R.S., Director of the Geological Survey of Ireland.—In an elaborate paper by Mr. W. Hopkins, entitled "Experimental Researches on the Conductive Powers of various Substances," published in the Philosophical Transactions for 1857, an account is given of a series of experiments made under the general supervision of Mr. Hopkins, F.R.S., himself, and Mr. W. Fairbairn, F.R.S., during the sinking of the Astley Pit of Dukenfield Colliery, in Cheshire.[1] At the time this paper was written, the depth attained was only a little more than 1,400 ft.; and the rate of increase between the depths of 700 ft. and 1,330 ft. was found to be 1° F. for about 65 ft. These observations were subsequently continued until the pits had attained their full depth of 717 yards from the surface. The last observation made was in the shale overlying the coal-seam, known as the "Black Mine," which it was the object of the proprietor, Mr. Astley, to reach, and the temperature was found to be 75° F. Assuming the "stratum of constant temperature," or, as it is also called by Humboldt, "the invariable stratum," to be that which was reached at 16·5 feet with a temperature of 51° F., the total increase of temperature would amount to 24° F., giving as the rate of increase 1° F. for every 88·925 ft. This is much below the average rate of increase.

During a part of the period above referred to (from 1854-56) another coal-pit was being sunk at Wigan, which reached the depth of 600 yards, down to the celebrated "Cannel Mine." At this pit similar

[1] The entire series of these interesting observations were kindly supplied to me by Mr. W. Fairbairn, and are published in *The Coalfields of Great Britain*, 2nd edit. p. 226.

observations on the temperature of the strata were made very carefully by the manager, Mr. Bryham, which were kindly communicated to myself for publication, and will be found in my work on the *Coal fields of Great Britain*. The ultimate temperature attained in this pit at the depth from the surface of 600 yards was found to be 72° F.; and assuming the invariable stratum to be the same as that at Dukenfield Colliery, the resulting rate of increase would be 1° F. for every 61·5 ft., which accords very closely with the result obtained by Professor Phillips, F.R.S., at the Monkwearmouth Colliery.

Since the time above referred to, the proprietor of the Rose Bridge Colliery, Mr. J. Grant Morris, determined to carry down the shafts from the "Cannel" seam to the "Arley" seam of coal, which was known to lie more than 200 yards below it; and consequently, in the spring of 1868, preparations were commenced for carrying out this project. In the incredibly short time of one year and two months the Arley coal was struck, and was found to be of good thickness and quality. The total depth reached was 808 yards, and the ultimate temperature in the coal itself was found to be 93¼° F. The manager of the colliery, Mr. Bryham, sensible of the value of observations on the temperature of the strata at such unusual depths (this being probably the deepest colliery in the world, certainly in Britain), made a series of observations with as much care as the circumstances would admit, and has entrusted them to me for publication.

The mode of taking the observations was as follows:—On a favourable stratum, such as shale, or even coal, having been reached, a hole was drilled with water in the solid strata to a depth of one yard from the bottom of the pit. A thermometer was then inserted for the space of thirty minutes, the hole having been sealed and made air-tight with clay. At the expiration of the half-hour the thermometer was taken up and the reading noted.

It might possibly be objected that the time allowed (thirty minutes) was insufficient for the imbedding of the thermometer, and that the readings are liable to error from this cause. I feel sure, however, that if any error has arisen, it is inappreciable, and does not in the least invalidate the general result. In fact I am assured by Mr. Bryham that, from actual testing on several occasions, he found less than this time of thirty minutes sufficient for the purpose required.

While the temperatures of the strata were being measured, observations were also carried on *pari passu* on those of the open pit during the descent. These are given in the table annexed. By a comparison of the results in the two columns, it will be observed that as the depth increased the differences between the corresponding temperatures in the pit and the strata tended to augment; in other words, the temperature of the strata was found to augment more rapidly than that of the open pit.

The effects of the high temperature and pressure on the strata at the depth of 2,425 ft. are, as I am informed by Mr. Bryham, making themselves felt, and cause an increase in the expense both of labour and timber for props. This colliery, in fact, will be in a position to put to the test our views and speculations on the effects of high temperature and pressure on mining operations.

In order to obtain the average rate of increase of heat, as shown by the experiments at Rose Bridge Colliery, we may assume (in the absence of direct observation) the position and temperature of the *invariable stratum* to be 50 ft. from the surface and 50° F., which is probably nearly the mean temperature of the place. With these data, the increase is 1° F. for every 54·57 ft., which approximates to that obtained by Professor Phillips at Monkwearmouth of 1° F. for about every 60ft.

If, on the other hand, for the purpose of comparison, we adopt the measurements for the *invariable stratum* as obtained at Dukenfield, we find the rate of increase to be 1° F. for every 47·2 ft., as against 1° F. for every 83·2 ft. in the case of Dukenfield itself. So great a discordance in the results is remarkable, and is not, in my opinion, attributable to inaccuracy of observation in making the experiments. On the other hand, I may venture to suggest that it is due, at least in some measure, to dissimilarity in the position and inclination of the strata in each case. These I now proceed to point out.

Position of the Strata at Rose Bridge and Dukenfield Collieries.—Rose Bridge Colliery occupies a position in the centre of a gently sloping trough, where the beds are nearly horizontal; they are terminated both on the west and east by large parallel faults, which throw up the strata on either side. The colliery is placed in what is known as "the deep belt."

Dukenfield Colliery, on the other hand, is planted upon strata which are highly inclined. The beds of sandstone, shale, and coal rise and crop out to the eastward at angles varying from 30° to 35°. Now I think we may assume that strata, consisting of sandstones, shales, clays, and coal alternating with each other, are capable of conducting heat more rapidly along the planes of bedding than across them, different kinds of rock having, as Mr. Hopkins's experiments show, different conducting-powers. If this be so, we have an evident reason for the dissimilar results in the two cases before us. Assuming a constant supply of heat from the interior of the earth, it could only escape, in the case of Rose Bridge, *across* the planes of bedding, meeting in its progress upwards the resistance offered by strata of, in each case, varying conducting-powers. On the other hand, in the case of Dukenfield the internal heat could travel along the steeply inclined strata themselves, and ultimately escape along the outcrop of the beds.

I merely offer this as a suggestion explanatory of the results before us, and may be allowed to add that the strata at Monkwearmouth Colliery, the thermometrical observations at which correspond so closely with those obtained at Rose Bridge, are also in a position not much removed from the horizontal, which is some evidence in corroboration of the views here offered.

THERMOMETRICAL OBSERVATIONS AT ROSE BRIDGE COLLIERY.

Date.	Depth in yards.	Strata.	Temperature in open pit.	Temperature in solid strata.
			°F.	°F.
July, 1854	161	Blue shale	...	64·5
August, 1854	188	Warrant earth	...	66
May, 1858	550	Blue shale	...	78
July, 1858	600	Warrant earth	...	80
May 18, 1868	630	"Raven" coal	73	83
July 24, 1868	665	Linn and Wool	75	85
April 19, 1869.....	673	"Yard coal" mine	76	86
November 18, 1868	700	Strong blue metal	76	87
February 22, 1869	736	Do.	76	88¼
March 12, 1869 ...	748	Shale	77	89
April 17, 1869 ...	762	Linn and Wool, or strong shale	78	90·5
May 3, 1869	774	Strong shale	80	91·5
May 19, 1869	782	Blue metal	79	92
July 8, 1869.....	801	Strong blue shale	79	93
July 16, 1869	808	Coal (Arley mine)	79	93¼

Remarks.—All holes vertical in solid at bottom of pit drilled with water 1 yard deep, and thermometer remained in hole thirty minutes and made air-tight with clay.

Thursday, February 3rd.—The following paper was read:—"Note on an Extension of the Comparison of Magnetic Disturbances with Magnetic Effects inferred from observed Terrestrial Galvanic Currents; and Discussion of the Magnetic Effects inferred from Galvanic Currents on days of tranquil magnetism," by G. B. Airy, Astronomer Royal.—The author, after referring to his paper in the *Philosophical Transactions* for 1868, on the Comparison of Magnetic Disturbances inferred from Galvanic Currents recorded by the Self-registering Galvanometers of the Royal Observatory of Greenwich with the Magnetic Disturbances registered by the Magnetometers, on 17 days, states that he had now undertaken the examination of the whole of the galvanic currents recorded during the establishment of the Croydon and Dartford wires (from 1865, April 1, to 1867, October 24). The days of observation were divided into three groups: No. 1 containing days of considerable magnetic disturbance, and therein including not only the 17 days above mentioned, but also 36 additional days; No. 2 containing days of moderate disturbance, of which no further use was made; and No. 3 containing the days of tranquil magnetism.

The comparisons of the additional 36 disturbed days were made in the same manner as those of the preceding 17 days, and the inferences were the same. The results were shown in the same manner, by comparison of curves, which were exhibited to the society. The points most worthy of notice are—that the general agreement of the strong irregularities, galvanic and magnetic, is very close; that the galvanic irregularities usually precede the magnetic, in time; and that the northerly magnetic force appears to be increased. The author remarks that no records appeared open to doubt as regards instrumental error, except those of western declination; and to remove this he had compared the Greenwich Curves with the Kew Curves, and had found them absolutely identical.

The author then proceeds with the discussion of the Galvanic Current-Curves on days of tranquil magnetism, not by way of comparison with the magnetic curves, but for independent examination of the galvanic laws. The method was explained of measuring the ordinates and connecting the measures into expressions for magnetic action, at every hour, and grouping the measures at the same nominal hour by months, and taking their monthly means for each hour. As these exhibited sensible discordance, they were smoothed by taking the means of adjacent numbers, taking the means of the adjacent numbers of the new series, and so on, repeating the operation six times. The author explains the theory of this process, and the way in which it tends to degrade the periodical terms of higher orders. He then explains an easy method of resolving the numbers so smoothed into periodical

terms recurring once in the day, twice in the day, thrice in the day, &c., and applies the method to the numbers for every month.

When these quantities (which from month to month are perfectly independent) are brought together in tables, they present such an agreement, with gradual change accompanying the change of seasons, as leaves no doubt on their representation of a real law of the diurnal changes of the galvanic currents. They also show the existence of a constant turn towards the north (which explains the apparent increase of force to the north observed in the results for days of great disturbance), and a still larger force towards the west (which also is well marked on the days of great disturbance). No light is obtained on the origin of these terms, but they appear to be probably pure galvanic accidents, depending on the nature of the earth-connections.

The author then exhibits in curves the diurnal inequalities of magnetism which the galvanic currents must produce. The form generally consists of two parallel lobes, making with the magnetic meridian an angle of nearly 60° from the north towards the west. The greatest east-and-west difference of ordinates, in the month of April, is 0·00044 of total horizontal magnetic force; it corresponds in the hours to which those ordinates relate, nearly with the ordinary diurnal inequality. But it is much smaller than the ordinary diurnal inequality, and the daily law of the galvano-magnetic inequality differs greatly from that of diurnal inequality. For the greater part, therefore, of diurnal inequality the cause is yet to be found.

"On the Fossil Mammals of Australia. Part III. *Diprotodon Australis*, Owen," by Prof. Owen, F.R.S., &c.—In this paper the author communicates descriptions, with figures of the fossil remains at his command, of *Diprotodon Australis*, which have been received from various localities in Australia, since the first announcement of the genus, founded on a fragment of lower jaw and tusk, described and figured in the appendix to Sir Thos. Mitchell's *Three Expeditions into the Interior of Eastern Australia*, 8vo. 1838.

The fossils in question include the entire cranium and lower jaw with most of the teeth, showing the dental formula of :—$i\,\frac{3-3}{1-1}$, $c\,\frac{0\,0}{0.0}$, $m\,\frac{5-5}{5-5}=28$; portions of jaws and teeth exemplifying characteristics of age and sex; many bones of the trunk and extremities.

After some introductory remarks, the author proceeds to the description of the skull and teeth, which are illustrated by many figures, those of the teeth being of the natural size. The result of the comparisons detailed establishes the marsupial character of Diprotodon, and the combination of characters of Macropus and Phascolomys with special modifications of its own. These latter are more fully and strongly manifested in the bones of the trunk and limbs, subsequently described. The pelvis and femora present resemblances to those in Proboscidea, not hitherto observed in any other remains of large extinct quadrupeds of Australia. But in all the bones described essentially marsupial characteristics are more or less determinable. The paper concludes with a summary of the characters of Diprotodon, throwing light upon the conditions of its extinction, its analogies with the Megatherium, its affinities to existing forms of Marsupialia and the more generalized condition which it manifests of that mammalian type.

A table of the localities in Australia from which remains of Diprotodon have been obtained, and a table of the principal admeasurements of the skeleton, are appended to the text.

GEOLOGICAL SOCIETY.

JANUARY 26TH.—Prof. Huxley, LL.D., F.R.S., president, in the chair, Thomas Daniel Bott, Esq., 2, Osborne villas, Talfourd-road, Peckham; Edwin Buckland Kemp-Welch, Esq., 3, Beaumont-terrace, Bournemouth; James Parkinson, Esq., F.C.S., Sarum House, Church-road, Upper Norwood; Henry Sewell, Esq., Villa del Valle, Mexico; and Thomas F. W. Walker, Esq., M.A., F.R.G.S., Athenæum Club, London, and 6, Brock-street, Bath, were elected fellows of the society. The Rev. Dr. Oswald Heer, of Zurich, was elected a foreign member of the society. The following communication was read:—

"On the Crag of Norfolk and associated Beds," by J. Prestwich, Esq., F.R.S., F.G.S.—The author commenced by referring to his last paper, in which he divided the Red Crag into two divisions—a lower one, of variable oblique bedded strata, and an upper one, of sands passing up into the clay known as the Chillesford clay. In 1849 he had alluded to the possibility of this clay being synchronous with the Norwich Crag. He has since traced this upper or Chillesford division of the Red Crag northwards, with a view to determine its relation to the Norwich Crag. He has found it at various places inland, but the best exhibition of it occurs in the Easton Bavant Cliffs. He there found it in a group of shells similar to those at Chillesford, and under it the well-known bed of mammaliferous or Norwich Crag, with the usual shells. The author also showed that in this cliff and the one nearer Lowestoft traces of the Forest-bed clearly set in upon the Chillesford clay. He then traced these beds at the base of Horton Cliff, and then passed on to the well-known cliffs of Happisburgh and Mundesley. He considered the Chillesford clay to pass beneath the Elephant bed, and to represent some part of the Forest-bed. The same clay may be traced to near Weybourne. The Crag under these beds he referred to the Chillesford sands. Mention was then made of the sands and shingle above the Chillesford, to which the author proposed the names of "Southwold Sands and Shingle." These usually are very unfossiliferous, but at two or three places near Southwold the author found indications of an abundance of shells (Mytilus, &c.) and foraminifera in some iron-sandstones intercalated in this series. In the Norfolk cliffs these beds contain alternating seams of marine and freshwater shells. The inland range of the beds to Aldeby, Norwich, and Coltishall was next traced, and the Chillesford clay shown to be present in each section, and the sands beneath to be referrible to the Chillesford sands, as already shown by other geologists on the evidence of organic remains. Mr. Gwyn Jeffreys, who had carefully examined the shells of the Norwich Crag for the author, stated that a considerable number of Arctic species were found in the Norfolk Crag which did not occur in Suffolk. While, therefore, the Norwich Crag seems to be synchronous with a portion of the Suffolk Crag, that portion is the upper division; and, therefore, the triple arrangement proposed by Mr. Charlesworth, and advocated by Sir C. Lyell, together with the fact of the setting in of a gradually more severe climate, pointed out by the late Dr. Woodward and by Sir C. Lyell, are confirmed.

Mr. Prestwich then referred to the origin of the materials of the Southwold shingle, and showed that, with few exceptions, they came from the south. In it he had found a considerable number of worn fragments of chert and ragstone from the Lower Greensand of Kent. He considered this a convenient base-line for the Quaternary period, as then commenced the spread of the marine gravels over the south of England, and soon after commenced the great denudations which give the great features to the country.

Discussion.—Mr. Gwyn Jeffreys observed that no littoral shells occur in the Coralline Crag, while in the Red Crag they abound. In the Norwich Crag there is also evidence of littoral conditions, but in certain places the shells exhibit a deep-water character. In the Norwich Crag, after eliminating as derivative or extraneous certain species (as had already been done by the late Dr. Woodward), he finds, exclusive of varieties, 140 species, of which 123 are living, and 17 are supposed to be extinct. Of these 123, 101 still live in the British Seas, 12 are Arctic and North American, 8 Mediterranean, and 2 Asiatic. The southern species were probably derived from the Coralline Crag. The two Asiatic species were the *Corbicula fluminalis* and *Paludina unicolor*. Twenty species in the Norwich Crag have not been found in the Red or Coralline Crag, and he therefore thought there was some difference in their geological age, the Norwich Crag being both more recent then the Red Crag, and its shells of an Arctic or more northern kind. *Tellina balthica* he regarded as significant of brackish-water conditions. *Actæon Noæ*, a characteristic shell of the Red and Norwich Crag, had been found fossil by Professor Steenstrup in Iceland.

Sir Charles Lyell had been struck with the similarity of the beds at Chillesford and at Aldeby, in which also the shells, though 40 in one case 70 in the other, were very similar in character; but in neither was *Tellina balthica* found, though common in the glacial beds. He called attention to the condition of the shells as they occurred at Aldeby, and suggested that where the two shells of a bivalve were found in contact, they would probably afford some evidence whether they were derivative or no.

Mr. Searles V. Wood, jun., was inclined to differ to a large extent from the author, especially with regard to the beds above the Chillesford clay. The sands containing *Tellina solidula* he placed as the lowest member of the glacial series; the fauna they contain is different from that of the Chillesford bed. He regarded the sand-beds at Kessingland as above the lower Boulder-clay and contorted Drift of Cromer, and considered that it might be traced as occupying this position along a great part of the coast of Norfolk. He had, in company with Mr. Harmer, surveyed a great part of the Norfolk and Suffolk district, and they intended to place their maps and sections at the disposal of the Geological Society and the Survey. He recommended that any examination of the country should commence from the east rather than from the west.

Mr. Boyd Dawkins, speaking of the fossil mammalia of the Crag, mentioned that at the base of the Crag at Horstead, immediately on the Chalk, was a bed exhibiting an old land-surface, and in this were found the principal perfect mammalian remains, whereas in the Crag above they were waterworn. But though these bones occurred in the marine deposit, the animals had lived on the land, and there was no evidence but that they belonged to a much earlier period than that at which it was submerged. He thought that the facies of the Cervidæ found at Horstead was that of an early Pliocene age. The mammals of the London Clay had in some cases become confounded with those of the Suffolk Crag, but these he regarded also as belonging to an old Pliocene land-surface. He differed from the author in not regarding the Forest-bed as Quaternary, as the remains of *Rhinoceros etruscus*,

Ursus arvernensis, and *Elephas meridionalis*, &c., had occurred in it, in many cases in fine condition. He could see no reason for splitting up the Cainozoic series into four divisions, as there was no break in the life between the Tertiary and Quaternary periods. Though there might be a break in England, the forms of life were continuous from the Miocene of Pikermi on the Continent.

The president suggested that if we were to admit a Quaternary period we must go back to the Miocene, as the mammalian faund of that period was the direct ancestor of that of the present day.

Mr. Prestwich, in reply, remarked that he did not quite agree with Mr. Jeffreys as to the number of derivative species in the different members of the Crag. The fauna, however, required further investigation. With regard to the objections of Mr. Wood, he had not on this occasion intended going into details as to the beds above the Chillesford clay; his object had rather been to show that these latter extended over a large area, and contained in other places than Chillesford the same shells as those occurring there. He did not attach the same value to the presence of *Tellina balthica* as did Mr. Wood, it being a shell now living and found on the coast. He had not overlooked the importance of the mammalian remains, but, like Mr. Dawkins, he had felt the uncertainty which, in the case of the Crag, so often attached to their origin, and therefore had not much insisted on them. He thought the divisions of Miocene and Pliocene were well known and generally accepted, and though the division was arbitrary, he thought the setting in of the Glacial period a good epoch at which to commence the Quaternary period. If we were to go back to some break in the forms of life, we might go back indefinitely.

ROYAL INSTITUTION OF GREAT BRITAIN.

General Monthly Meeting, Monday, Feb. 7th.—J. P. Gassiot, Esq., F.R.S., V.P., in the chair. Lord Brabazon, Robert Dudley Baxter, Esq., Miss Mary Browne, Michael Carteighe, Esq., Charles Lukey Collard, Esq., Miss Anne Gassiot, Mrs. J. H. Gladstone, Rodolph Alexander Hankey, Esq., Mark Henry Lackensteen, M.D., M.R.C.P., F.L.S., F.C.S., George Andrew Spottiswoode, Esq., were elected members of the institution. Twenty-nine persons were proposed for election as members at the next monthly meeting.

ZOOLOGICAL SOCIETY OF LONDON.

January 27th.—Professor Newton, V.P., in the chair. A letter was read from Mr. R. B. White, C.M.Z.S., concerning the Hairy Tapir (*Tapirus roulini*) of the Andes of New Grenada, of which he was endeavouring to obtain specimens for the society's menagerie.

Dr. Cobbold, F.R.S., exhibited specimens of, and made remarks upon, the new Entozoon from the Aard-wolf, described at the last meeting of the society, and proposed to be called *Acanthocheilonema dracunculoides*.

Mr. G. Dawson Rowley, F.Z.S., exhibited and made remarks upon a specimen of the Siberian Lark (*Alauda Sibirica*), recently taken near Brighton, and believed to be the first example of this species that had occurred in the British islands. Mr. Rowley also exhibited some other rare birds from the same locality.

Professor Newton, in exhibiting a specimen of the North-American *Zonotrichia albicollis*, shot near Aberdeen, and sent to him for that purpose by Mr. W. C. Angus, called attention to the injudicious practice of many ornithologists who are prone to give the name of "British Birds" to all such foreign species as occasionally stray to this country.

A communication was read from Professor Owen, containing a letter received from Dr. Haast, F.R.S., on the discovery of cooking-pits and kitchen-middens containing remains of various species of Dinornis, in the province of Canterbury, New Zealand.

Mr. P. L. Sclater read a paper on some new or little-known birds from the Rio Paranà, collected during the second survey of that river by Captain Page, U.S.N., and submitted to him for examination by the Smithsonian Institution.

Dr. W. Baird communicated a description of a new genus and species of shells from Whydah, on the West Coast of Africa, proposed to be called Protoma, together with some remarks on the genus Proto of Defrance.

Mr. R. B. Sharpe read a paper on the genus Pelargopsis of the family Alcedinidæ, and pointed out the geographical distribution of the eight species of this genus in the Indian and Australian regions.

Mr. Sharpe also exhibited and pointed out the characters of a new species of Campephaga from Damara-land, which he proposed to call *Campephaga Anderssoni*, after the late Mr. C. J. Andersson, its discoverer.

Dr. J. E. Gray communicated some notes on the skulls of the Whales of the genus Orca in the British Museum, and a notice of a specimen of the same genus from the Seychelles.

A communication was read from Dr. J. C. Cox, C.M.Z.S., containing descriptions of seventeen new species of Land Shells from the South Sea Islands. The original specimens were stated to be in the cabinet of Mr. John Brazier, of Sydney, C.M.Z.S.

A communication was read from Lieut.-Col. Playfair, F.Z.S., containing an account of a fresh-water fish recently discovered in the vicinity of Aden, which appeared to be referrible to the widely-distributed Cyprinoid, *Discognathus lamta*.

Dr. J. Murie read a note upon a larval œstrus found in the orbit of the Hippopotamus, to which was added a list of the species of Mammals in which œstri-larvæ have hitherto been found.

Dr. Murie also read a note on a specimen of the so-called *Aquila Barthelemyi* recently living in the society's gardens, which appeared to be nothing more than a variety of the Golden Eagle (*Aquila fulva*).

ANTHROPOLOGICAL SOCIETY.

At the evening meeting held on the 1st inst., Captain Bedford Pim, R.N., V.P., in the chair, Major Frederick Millingen, F.R.G.S., read a paper "On the Negro Slaves in Turkey."—The author exposed first the particulars connected with the sale of Negro slaves in Mussulman countries, then he described the lot which awaits the Negroes in Turkey, and concluded by some general observations on the question. With regard to the slave trade carried on in Turkey, the Major said that the Negroes imported into the Sultan's dominions come from the countries situated on the higher basin of the Nile; and that though that valley is the route followed by the cargoes of slaves on their way to the markets, numbers of secondary channels exist, through which slave-dealers convey their merchandise. So long as that supply and demand exist, it is useless to hope that slavery will be done away with. The causes of the supply are the feuds of the Negro races, which will never end: the causes of demand are that slavery is inherent in the religious system, inherent in the social system, and congenial to the ideas and manners of Mussulman nations. With regard to Sir Samuel Baker's expedition to put a stop to the slave trade, the author stated that the undertaking was impossible, as Sir Samuel, placed between two fires, supply and demand, must end by being defeated by both. The Major quoted the speech pronounced lately at the Geographical Society's meeting by Lord Houghton, who plainly avowed the disappointment felt by his friend Sir Samuel Baker on seeing the Mussulmans hostile to his scheme. In conclusion, the author said that, if the Sultan and the Khedive really intend doing away with slavery, the thing is easily realized: they have nothing else to do but to open wide the gates of their harems.

THE INSTITUTION OF CIVIL ENGINEERS.

February 1st.—Charles B. Vignoles, Esq., F.R.S., president, in the chair. The paper read was "On the Statistics of Railway Expenditure and Income, and their bearing on Future Railway Policy and Management," by Mr. John Thornhill Harrison, M. Inst. C.E.

At the monthly ballot the following candidates were balloted for and declared to be duly elected:—as members, Messrs. G. Allan, A. W. Craven, G. C. Greenwell, J. Hendry, S. G. Purchas, and J. B. Simpson; and, as associates, Captain W. H. Beckett, Messrs. H. Hakewill, J. I. Hopkins, T. Horn, W. C. Luard, R. E. Middleton, F. Morris, G. J. Morrison, P. A. H. Noyes, Stud. Inst. C.E.; A. C. Pain, J. T. Potts, E. T. Q. de Rochemont, W. Stead, and E. Wilson.

A report was brought up from the council stating that, under the provisions of Sect. IV. of the By-laws, the following candidates had been admitted students of the Institution since the last announcement:—Messrs. T. B. Fry, W. Greenwood, G. G. M. Hardingham, J. Heinig, S. Preston, T. E. West, and A. P. Wright.

INSTITUTE OF ACTUARIES.

The third ordinary meeting of the present session was held on Monday, January 31, Samuel Brown, Esq., president, in the chair. The following gentlemen were elected associates, viz., Messrs. Duncan MacLauchlan, Slater, and Josiah Samuel Parker. The following is the result of the recent examinations:—

Matriculation Examination.—Twenty-three gentlemen presented themselves for this examination, of whom two withdrew, and twelve passed in the following order of merit, viz., 1. B. Reynolds, 2. A. C. Waters, 3. G. Todd, 4. J. Pringle, 5. D. F. Park, 6. C. Oldham and T. E. Young, 8. Clarence Smith, 9. W. T. Gray, 10. J. Burne, 11. E. T. Sims, jun., 12. J. H. Adey.

Second Year's Examination.—Three gentlemen presented themselves for this examination and two passed in the following order of merit, viz.,—1. T. N. Toller, 2. J. C. Hopkinson.

Third Year's Examination.—Two gentlemen presented themselves for this examination, and passed in the following order, viz., 1. F. Addiscott, 2. W. Hughes.

Prof. Oppermann read a paper "On the Graduation of Life Tables, with special Application to the Rate of Mortality in Infancy and Childhood." Mr. W. S. B. Woodhouse read a paper "On a new Method of adjusting Mortality Tables."

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

ORDINARY MEETING, JANUARY 25TH.—J. P. Joule, LL.D., F.R.S., &c., president, in the chair. A paper was read by Dr. R. Angus Smith, F.R.S., &c., "On Organic Matter in the Air," which we reproduce in full in another column.

Professor Williamson, F.R.S., exhibited some specimens affording additional information in reference to the organization of Calamites. Through the perseverance of his fellow-labourer, Mr. Butterworth, he had now obtained, what he had some time ago expected to do, examples whose structure was intermediate between that of Calamodendron and Calamopitus. In the general arrangement of their separate parts these new specimens corresponded most closely with the well-known type figured by Mr. Binney; but they differ in two important particulars. All their fibro-vascular tissues are of the reticulate type seen in Calamopitus and Dictyoxylon, with here and there a few scalariform vessels interspersed. The cellular laminæ separating the vascular wedges again exhibit remarkable variations even in the same specimen; their cells being sometimes elongated into vertical forms of prosenchyma—at others they are extended transversely, parallel to a tangential section—whilst still more frequently they consist of ordinary parenchyma. In another feature, also, the specimens exhibit considerable variations. In some the fibro-vascular tissues of the vascular wedges are separated by masses of cellular tissue, not only at the nodes, but also at the internodes. These tissues which, viewed physiologically, can only be regarded as modified medullary rays, are so numerous in one example that more than two vertical vessels can rarely be found in contact without the intervention of one of these vertical rows of mural cellular tissue. In some other examples these medullary rays are much more scanty, as if connecting the type under consideration with that figured by Mr. Binney. The verticillate medullary radii of Calamopitus are wholly wanting in these new examples. Additional proof is thus afforded that all the three types referred to may be but variations, possibly having no more than specific value, and perhaps not always even that, of the common type of Calamodendron; and it thus becomes increasingly demonstrable that in the Lancashire coalfield, whatever may be the case elsewhere, we have no evidence of the existence of an equisetiform type of Calamite distinct from the calamodendroid one.

Professor Williamson further announced the discovery by Mr. Butterworth of a young Calamite in which the cortical layer is well preserved. This important fact has long been a desideratum in connection with English palæo-phytology. This investing layer proves to be, as Professor Williamson in his previous memoir on Calamopitus had suggested was probably the case, a parenchyma of somewhat remarkable structure, and of a thickness equal to that of the ligneous zone which it invests. But as the investigation of this new tissue is not yet completed, all further description of it must be reserved for some future occasion.

"On the so-called Molecular Movements of Microscopic Particles," by Professor William Stanley Jevons, M.A.—Robert Brown, the celebrated botanist, first pointed out, in the year 1827, that minute particles of unorganized matter suspended in water exhibit movements which may easily be mistaken, and were formerly mistaken, for the movements of living animalcules. This motion is exhibited more or less by all substances which are reduced to a sufficiently fine state of division ($\frac{1}{5000}$ in. in linear magnitude to $\frac{1}{20000}$), and the phenomenon is familiar to all occupied in microscopic observation. Vague suggestions have been often put forth that the motion is due to heat, to electricity, or to chemical affinity; but I have been able to find few published experiments on the subject, and those not of a conclusive kind.

In investigating this phenomenon, I did not learn much by varying the solid suspended substance. The silicates, indeed, appeared to be generally the most active substances, and the purest quartz crystal, when reduced to fine powder, oscillated rapidly; but such different substances as charcoal, red phosphorus, antimony, and sulphur were also very active. I cannot affirm that any substance is free from movement, but the metallic oxides, and the earthy salts, such as carbonate of lime, appeared to me somewhat less active in comparison.

In varying the liquid, however, by dissolving different salts therein, I was soon struck by the fact that the purest distilled water alone gave the movement in the highest perfection. With a few exceptions, soon to be noticed, all acids, alkalis, or salts tended to diminish the movement in a manner wholly independent of their peculiar chemical qualities.

The inquiry was much facilitated by discovering that the microscopic movement is closely connected with the suspension of fine powder in water.[1] Clay and pounded glass, which are most active in the microscope, are also capable of remaining long in suspension. All acids, alkalis, or salts which checked the motion under the microscope were found also to have a power which has not been sufficiently noticed, of precipitating suspended matter. At the same time gum arabic, which possesses a most extraordinary power of exciting the molecular movement, is also capable of maintaining powder in suspension, and has long been used for this purpose in the manufacture of ink. The molecular motion does not directly affect the gravity of the particles, but it prevents the particles from aggregating together into larger bodies and thus overcoming the resistance of the liquid.

That the motion is due to electricity I was soon convinced, by the close analogy with the circumstances in which electricity is produced by the hydro-electric machine. Armstrong and Faraday found that pure water in this machine alone produced much electricity, and that almost any salt, acid, or alkali prevented the action by rendering the water a conductor. Ammonia, however, is a remarkable exception, because it does not render water a good conductor, and does not prevent the hydro-electric machine from giving off electricity. In trying ammonia as an *experimentum crucis*, I found that it did not stop the microscopic movement, and had almost an inappreciable effect in precipitating suspended matter. A solution of 10 per cent. of ammonia would have less effect than $\frac{1}{10}$ per cent. of sulphuric acid. The proof is rendered practically certain by the fact that boracic acid which was also ascertained to be a non-conductor by Faraday, does not precipitate matter from suspension.

It is right to add, however, that in the case of acetic acid there is a discrepancy; Faraday stated that it does not render water a conductor; but I find that in common with the other vegetable acids which I have tried it occasions precipitation. The conducting qualities of the substance have not been determined with sufficient accuracy to render a mistake impossible.

It is probable that silicic acid does not render water a conductor, as I find that silicate of soda tends to increase rather than diminish microscopic movement, and is another remarkable exception to the general precipitating power of soluble substances.

I entertain no doubt that microscopic movement is closely connected with the phenomena of osmose so fully investigated by the late Mr. Graham. The connection is that of action and reaction; for if a liquid is capable of impelling a particle in a given direction, the particle if fixed is capable of impelling the liquid in an opposite direction by an equal force. The earthenware jars used by Graham in many of his experiments are composed of a substance highly active under the microscope, and the fact that osmose is most shown by very dilute solutions (1 p.c. or less) is entirely in accordance with the electric origin of the phenomenon.

I consider it to be established experimentally that the microscopic movement is due to electric action, and if I may venture to suggest a somewhat speculative explanation of the action I would point to the experiments of M. Wiedemann on electric osmose. It was first observed by Mr. Porret that when the poles of a battery are placed in two portions of water separated by a porous division, not only is some of the water decomposed, but another and far larger portion is impelled towards the negative pole. M. Wiedemann having exactly investigated the phenomenon found that for one part of water decomposed 5,000 parts were transported through the porous septum. This impulsion is greater as the resistance of the liquid is greater, and ceases altogether when sufficient acid or salt is added to render it a good conductor. Every particle which is thrown into a polar condition by the action of water must be capable in a minute degree of exerting a similar force. In ordinary osmose the particles being fixed cause a transportation of the fluid; in microscopic movement, on the other hand, the particle is free to move, and the reaction of the liquid probably produces those movements which are visible in the microscope.

Although I have chiefly confined my attention to inorganic substances, I have also found that all organic solid particles which are sufficiently small exhibit the movements in a high degree. Albumen, dextrin, grape or cane sugar, starch solution, alcohol, &c., seem to have little or no power of destroying the motion; and the extraordinary properties of gum arabic have been noticed. I think it not unlikely that when these phenomena are fully investigated they will give strong support to a theory lately put forward by M. Becquerel, that the movements of fluids in animals and plants, which have often been attributed by Graham and others to osmose, are really due to minute electric currents.

Mr. Dancer, F.R.A.S., stated that the subject which Professor Jevons brought before the meeting, was one to which he had paid attention at intervals for the last thirty years. He had repeated Dr. Robert Brown's experiments with the majority of the substances named in his paper, and had also experimented with a great number of other substances and different solutions.

[1] I have since found that the microscopist Dujardin noticed this connection. See *Manuel complet de l'Observateur au Microscope*, p. 60. Paris, 1843.

The particles approaching a spherical form gave evidence of the greatest activity, with some few exceptions. The activity and duration of the movements vary according to their magnitude, and also the solution in which they are suspended. For instance, some of the metallic oxides would exhibit the movement for some time, and then gradually get aground on the glass plate, and cease to move. There was some difficulty in reducing metals to particles sufficiently small and regular in form for the exhibition of the molecular movement; even hardened steel, when rubbed on a very fine hone, appears fibrous, and soft metals such as platinum and copper, like shavings, under a high magnifying power. Those siliceous particles of the hone which have their lines of cleavage favourably situated are frequently detached in thin plates during the act of grinding and form brilliant objects when viewed by polarized light. Metals reduced in this manner require re-grinding several times before they lose their fibrous character, and become sufficiently minute for successful experiments.

Metallic oxides vary considerably in their form and magnitude, according to the solutions from which they are precipitated. By practice it would be possible in many cases, by their microscopical appearance, to name the solutions from which they had been precipitated. The activity of these, when of favourable size, say from $\frac{1}{10000}$ to $\frac{1}{20000}$ of an inch, is very different, being great in water, solution of gum, sugar, &c., but quite inactive in oil.

Mercury and sulphur when sublimed assume a spherical form, and although these spheres could be obtained from $\frac{1}{1000}$ to $\frac{1}{20000}$ of an inch in diameter, they do not exhibit any movement in water. He has sublimed them on to a drop of water, by they refused to sink. Possibly their polished surfaces retained a film of air which floated them. So transparent and perfect in form are the sulphur spheres that they distinctly exhibited the image of a lamp-flame at their focal point. Triturated or precipitated sulphur will exhibit active movement in various solutions. As regards the cause of this so-called molecular movement, Mr. Dancer thinks that chemical action will not account for it. Diamond dust, graphite, and other refractory substances, are found to be active in water and solutions of gum. Nor is electricity a satisfactory explanation to him. He has found that particles did not show a marked alteration in their movements, when exposed to electrical influence. The results of many experiments point to heat as a probable cause, and although the peculiar movements of these particles appear like electrical attraction and repulsion, similar movements might be caused by the changes of temperature of the particles, transmitted through the solutions.

"On a General System of Numerically Definite Reasoning," by Professor William Stanley Jevons, M.A.—The system of numerical reasoning described in this paper arises from the combination of arithmetical or algebraical calculation with logical reasoning. Its purpose is to determine as far as possible the numbers of individual objects which may compose classes or groups of objects under any given logical conditions, the data consisting in those logical conditions and the numbers of individuals in certain other related classes.

NORTH STAFFORDSHIRE NATURALISTS' FIELD CLUB.

The second evening meeting for the winter season of this club, which is now of some years' growth, and numbers near two hundred members, took place on January 21st, at Stoke-upon-Trent. The club has made excursions, amongst other places, to Dovedale, the Roches, Thor's Cavern, Trentham, Wybunbury Moss, Northwich Salt-mines, Dudley Caverns, and Beaudesert. The Rev. S. S. Nevill, F.L.S., occupied the chair on this occasion.

Mr. J. Ward read a paper on several Sigillariæ which had been laid bare on the floor of a fire-clay pit at Shelton and the neighbourhood. Some doubt had been felt whether they were Sigillariæ or not, but Mr. W. believed them to be so, though none of the characteristic scars were visible on their surface, the bark not being represented; indeed some specimens are only the fossilised internal cylinders of the trees, and of these the original butts must have been very large. In the interior of one of these was an appearance of a calamite having sprung up in the hollow trunk, but Mr. W. believed it to represent the axis. Another appearance mentioned was that of a longitudinal groove (commonly, he thought, on the north side of the fossils) which might have been caused by some parasitical climber.

Mr. Garner, V.P., mentioned that these fossils stood very thick in the North Staffordshire Coalfield; he had preserved three or four from the Harecastle Tunnel, and several of these had the peculiar scars of Sigillaria, others had been found with the roots (Stigmariæ) attached. Some of these roots appear as if split, showing a central axis and a pinnate appearance; and the larger roots appear to be composite, having more than one such inner bundle. The trunks are always perpendicular to the bedding, and invariably contain fragments of ferns, calamites, and other plants in their interior. He thought that the nut (Frigonocarpon) found in the interior of one of the trees had not been made out to be the fruit of it.

A paper was read by the last-named member on the zoology of the Isle of Man, especially of its southern extremity. Of the island generally he observed that no snake, mole, or toad is to be seen, and it is believed that the fox, magpie, hedgehog, badger, and polecat are either absent altogether, or, if found, have been introduced in recent times. Frogs, though plentiful, are also supposed to have been introduced, but two species of lizards appear to be indigenous. As is well known the domestic cat of the island is tailless, as is also the common fowl. The absence of the above-mentioned vertebrates, the prevalence of bogs and of the inhumed Megaceros, as well as the physique and language of the real Manx, lead to a comparison of the Isle of Man with Ireland. At the same time it appears probable that Man has no plant which is unknown in England. The fishermen of Port Erin he found willing to assist in zoological research, but on this occasion he confined himself to an overhaul of the lobster-pots and deep lines placed beneath the cliffs extending from Fleshwick Bay to the Gulf, a wild and picturesque spot, where the strong current rushing northwestwards through the neighbouring straits carries a plentiful harvest for the naturalist. In the course of a week he obtained *Tritonia arborescens*, Cuv.; *Comatula rosea*, the rosy feather-star of large size; *Ophiocoma granulata*; *Uraster glacialis*, badly figured by Forbes, and here of great beauty; Luidia, also of large size and equally beautiful; and the crimson Cushion-star (*Goniaster Templetoni*). Some of these were hooked, some apparently entangled by the lines in mid-water. Another curious take was a mass of the ova of a *Loligo* (probably *todarus*), contained in blunt rods of jelly about as thick as the finger, a foot long, and united at the slenderer summits into a great bunch. The red gurnet when just caught was very beautiful, intensely red above and as purely white below; but the blue-striped wrasse was still more spendidly tinted; there was also the rarer red, or three-spotted, wrasse. The spotted dog-fish died immediately when taken in, but the immense congers required decided treatment. Tubulariæ were also obtained, and a little luminous annelide was taken from the seaweed, and might be mounted for the microscope. The crustacea were *Pilumnus hirtellus*, *Portunus corrugatus*, the long-legged spider-crab, the scorpion spider-crab (Bell), and Galathea. On the shore at a low tide were found plentifully, *Sagartia venusta*, *S. bellis*, *S. dianthus*, *S. nivea*, and *A. gemmacea*.

Mr. Kirkby, last summer, followed the steps of the vice-president over the heaths at the extremity of the island, and displayed a case of insects which he had there collected. One of the Hemiptera, probably a Eurygaster, abounded on the bramble. Amongst the Lepidoptera were the meadow-brown, the grayling, the wall B, the small copper, the silver-studded blue, and the common blue. Of moths were the humming-bird a Sesia feeding on the thrift, the pretty heath, the burnet, *Abraxus ulmaria* and *grossulariata*, and others less notable, but perhaps more interesting to the entomologist, though indeed of no great rarity. Insects, however, seem to abound on the flowery commons and rocky knolls. Mr. Kirkby also presented a colony of minute house-ants, which he caught, a few days before, on his plate at a dining-room in the city.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

At a meeting held January 25, Mr. F. Enock read a paper, entitled, "Notes on Insects captured in 1868 and 1869," in which, after making an earnest appeal to the members of the society to engage in the study of the habits and instincts of the Lepidoptera, he described in detail the incidents of his own numerous night-excursions in the woods of Sutton Knowle and other localities in this district, for the purpose of "sugaring" for the night-flying moths, during which an hour's rest among the heather or bracken, between the several "flights" of the insects, has been the usual preparation for a long walk home in the early dawn of the following day. Mr. Enock's researches during the exceptionally prolific season of 1868, and the equally barren one of 1869, yielded him some 700 specimens, which formed the principal part of a beautiful collection displayed on the table, the singularly careful preparation and arrangement of which elicited general and hearty admiration, as well as afforded convincing evidence of the perseverance and zeal of the owner. Among the more important captures recorded may be mentioned the following, the value of which will be at once recognized by those of our readers who have pursued the fascinating study of entomology:—*Chærocampa celerio*, *Sphinx convolvuli*, *Geometra papilionaria*, *Scotosia undulata*, *Notodonta dictæa*, *N. ziczac*, *N. dromedarius*, *Drepanula hamula*, *D. lacertula*, *D. falcula*, *Triphæna fimbria*, &c. The interesting subject of the causes of the occasional appearance of extremely rare insects, and the probable means of their transport to localities to which they are usually strangers, and the periodic flights of Noctuæ at regular intervals during the night, subsequently formed the ground of an interesting discussion.

BELFAST UNITED NATURAL HISTORY SOCIETIES.

The seventh meeting for this session of the Natural History and Philosophical Society and the Naturalists' Field Club took place at the museum, on the evening of Wednesday, the 26th of January. The chair was occupied by Professor James Thomson. A paper was communicated by Mr. Robert W. Armstrong, resident partner in the Belleek Porcelain Works, County Fermanagh, illustrative of the pottery manufacture carried on there. In the unavoidable absence of Mr. Armstrong, the paper was read by the senior secretary, Mr. A. O'D. Taylor. It first gave an historical outline of the ceramic art, as practised in various countries from the remotest period of which we have any record. Statements in the Old Testament, extracts from Diodorus Siculus, from Homer, and from Chinese chronicles were given, showing the great antiquity of the potter's art, and the high estimation in which it was held. Its progress in more modern times and in our own country was then sketched. That branch termed "fine pottery" formed the chief subject of the paper, embracing under the general term "white ware" the three compositions known as delft, stoneware, and porcelain. Delft is a porous, bibulous body, which, only for the thin film of glass, by which its surface is covered as a glaze, would absorb all fluid matter coming in contact with it, until thoroughly saturated.

The pottery now made in Staffordshire, however, has a small portion of a vitrifying ingredient introduced into it. Stoneware, properly speaking, is a thoroughly vitrified composition, not requiring any glaze to prevent absorption, and though not transparent, when viewed through a thin fracture, shows its vitreous composition. Porcelain is a term applied generally to that class of pottery which is transparent, beautifully white and glossy, resembling china. Its bisque state may be seen in figures, and in busts and statuettes with a waxy substance, and in the delicate, ivory-tinted china as made at Belleek. This china is a real porcelain, the result of the simple vitrification of felspar and china clay, in contradistinction to the phosphate of lime or "bone body" used in England. The abundance of felspar near Belleek, and of pure flint, is a leading element in rendering the manufacture there so cheap. The various materials used were exhibited, and the various processes described, from the mixture of the slop-material to the very finest style of decorating the baked and perfected product. It was stated that some of the articles produced at Belleek contain as much as 72 per cent. of the local felspar. In addition to the potter's manual art, mechanical means have lately been introduced by which an important class of goods is formed in large quantities, such as white and coloured tiles, and porcelain insulators for telegraphic purposes. The composition requisite for these is used in the form of a dry dust or powder, and forced by machinery into metal moulds having the shape of the desired articles.

A large trade has been developed for these products, and in the domestic and fancy department of dinner ornamental ware, and figures. It is a most gratifying circumstance to learn that her most gracious Majesty Queen Victoria has patronized, to a very large extent, this new branch of Irish industry. The demand for Belleek ware is rapidly increasing, and an inspection of the specimens submitted at this lecture amply supported the opinion that in delicacy of texture and beauty of design, the Belleek ware need fear no competitor. The importance of the ceramic art, as now existing in Great Britain and Ireland, may be inferred from the following brief facts:—Speaking in round numbers, two and a half millions' worth is exported; one million's worth is used at home annually; 800,000 tons of coal are burnt in the potteries; 250,000 tons of clay, spars, and bones are used, and not less than 800,000 men, women, and children find employment in the various departments of the trade. The paper, of which the foregoing is, from the press of other matter, but an imperfect sketch, seemed to elicit much attention, and gave rise to an interesting subsequent conversation amongst the gentlemen present.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

Paris, January 31st.—Of the candidates for the post vacant in the bureau of longitudes, through the death of M. Darondeau, the Academy placed M. De la Roche Poncié first by 40 votes, against 8 recorded for M. Gaussin.

Among the correspondence was a note by M. Dareste on the subject of the relation which can be established between the development and convolutions of the brain, and the weight of the animal to which the brain belongs.

M. Adolphe Chatin sent in an account of his researches on the cause of the dehiscence of anthers.

A voluminous atlas of eighty plates, representing trichinæ and the varieties of cysts to which these parasites give rise, was laid on the table.

M. Adam sent in a reply to M. Becquerel relative to the process recently described for the nickelization of metals.

M. Leymerie, professor in the Toulouse Faculty of Sciences, communicated a short note on the non-existence of coal in the French Pyrenees.

In a communication by M. Lallemand, he stated that light which, as Schrotter has shown, turns ordinary phosphorus into its red modification, can exercise similar action upon sulphur,—that is, it can render insoluble in sulphide of carbon sulphur that was readily soluble in this menstruum. In order to prove this, the author hermetically seals a tube containing a saturated solution of sulphur in sulphide of carbon, and then places some point of the walls of the tube in the focus of a lens transmitting the solar rays. Very soon a slight deposit of sulphur is perceived at this point, which rapidly increases,—and this deposit consists exclusively of the insoluble variety. M. Lallemand considers that this curious molecular action is due exclusively to the chemical rays of sunbeams.

M. Bourgoin communicated a paper on the electrolysis of a solution of oxalic acid. He thinks that it is the crystallized acid itself which undergoes the electrolysis.

A memoir by MM. Troost and Hautefeuille was read on the determination of the heat of combination of boron with chlorine and with oxygen. Of all the members of its natural family, carbon is that which gives the least heat in burning in oxygen, namely, 8,000 calories. Boron gives 14,400 calories, and the authors intend to show, in a future paper, that silicon gives a much larger number still. Now, it is established that the facility of combustion follows just the opposite order, and MM. Troost and Hautefeuille see in this fact an analogy with the phenomena of passivity.

M. Daniel communicated a paper on the action of magnetism on rarefied gases.

M. Duméril presented, in terms of great praise, the last parts of the work on the zoology of Mozambique by Signor Carboni of Bologna.

Signor Carboni sent in a note to prove that *Epiornis maximus* was a bird of prey.

NOTES AND MEMORANDA.

Anatomy in Italy.—According to the *Athenæum*, the editors of *Archivio per la Zoologia, l'Anatomia e la Fisiologia* have just brought out the first volume of a second series, which includes an edition of 100 copies only, illustrated with seventeen well-executed plates. To those who wish to know the progress making in Italy in the branches of science above named, this volume will be particularly interesting. Among the articles are two by Richiardi—on the vascular system of the eye of the fœtus, monograph of the family of the Pennatularii (with fourteen plates); one by Canestrini on fishes of Australia; Bonizzi has one on a variety of the species *Gasterosteus aculeatus*; and Ciaccio contributes experiments upon the action of certain colouring matters and chemical substances on the spermatozoa of the frog and the triton. The structural details of the Pennatulæ are remarkably well shown in the lithographic plates.

A Universal Galvanic Battery.—The *Chemical News* gives the following abstract of a paper which recently appeared in *Cosmos* by M. Delaurier:—The author describes, at great length, and accompanied by a woodcut, a Bunsen cell modified by him. He uses an impure chromic acid, and a mixture of persulphate of iron and sulphuric acid. How the impure chromic acid is prepared is not mentioned. Instead of sulphuric acid, a solution of common salt (1 part in 10 of water) is often applied, and the amalgamation of the zinc is dispensed with; this arrangement appears, according to the statements made, to be satisfactory in many instances. The intensity of the action of the cell when chromic acid, persulphate of iron, and sulphuric acid are used, is very great; and the vapours of hyponitric acid, so deleterious with the Bunsen cells, are, of course, avoided.

Kangaroo Meat for England.—Mr. D. Tallerman, of London, writes to the *Australasian*:—"Two things exist in the colonies that are looked upon as a positive pest where they abound, and yet, with a little trouble, they can be made a source of immense profit to those concerned. I allude to the kangaroo and the rabbit. The first is admirably adapted for sausages, and if made the same size and shape of the ordinary German sausage, would sell well in this market at 1s. per lb. With a moderate-size chopping-machine and a two-horse engine, from two to three tons per day could be turned out. They could be well packed in fat, when they would reach here in fine condition. I think Mr. Michie, in one of his celebrated lectures, referred to the kangaroo sausage, and could possibly give further information about them; at any rate, the subject is well worth the attention of settlers in the Western district, where they abound." A trade in this way, says *Applied Science*, ought also to be done in Tasmania.

Natural History Society of Dublin.—The following are the officers for 1870:—President—the Right Honourable Lord Clermont. Vice-presidents—William Andrews, Esq., M.R.I.A.; Alexander Carte, Esq., M.D., F.L.S.; Robert Callwell, Esq., M.R.I.A., V.P.R.G.S.I.; Rev. Samuel Haughton, M.D., D.C.L., F.T.C.D. Council—Professor Ball, M.A., M.R.I.A.; H. M. Barton, F.R.G.S.I.; George Dixon, F.R.G.S.I.; Arthur W. Foot, M.D., F.K.Q.C.P.; A. H. Jacob, M.D., F.R.C.S.I.; T. Kift, Esq.; John J. Lalor, M.R.I.A.; David Moore, Ph.D., F.L.S., M.R.I.A.; Professor Traquair, M.D., F.R.G.S.I.; J. Todhunter, Esq.; H. Wilson, M.D.; R. P. Williams, M.R.I.A. Honorary Treasurer—Arthur Andrews, Esq. Honorary Director of Museum—E. J. Montgomery, Esq. Honorary Secretary—Professor Macalister.

SCIENTIFIC DIARY.

WEDNESDAY, February 9th.

Society of Arts, 8 p.m. "On Loss of Life at Sea," by J. W. Wood, Esq.
Royal Microscopical Society, 8 p.m. Anniversary meeting, President's Address, &c. Annual election of officers.
Royal Literary Fund, 3 p.m.
British Archæological Association, 8 p.m.
Graphic Society, 8 p.m.
Geological Society, 8 p.m. "Fossil Corals of the South Australian Tertiaries," by Prof. P. Martin Duncan. "Note on a large undescribed Wealden Vertebra," by Mr. J. W. Hulke. "Additional Observations on the Neocomian Strata of Yorkshire and Lincolnshire, &c.," by Mr. J. W. Judd.
Belfast Natural History Society, and the Belfast Naturalists' Field Club, 8 p.m. "Smell and Smells," by the Rev. Edmund M'Clure.
Hunterian Society, 8 p.m., at the London Institution. The Hunterian Oration, by T. Bryant, Esq.

THURSDAY, 10th.

Royal Society, 8.30 p.m. "On some Remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium," by H. C. Sorby, F.R.S. "On the Mathematical Theory of Stream Lines, especially those with Four Foci and upwards," by Prof. Rankine, F.R.S. "On Linear Differential Equations," by W. H. L. Russell, F.R.S.
Mathematical Society, 8 p.m. "Quartic Surfaces," by Prof. Cayley.
Zoological Society, 8.30 p.m. "New Cervine Animal from the Yang-tse-Kiang," by Mr. R. Swinhoe. "Size of Red Corpuscles of the Blood of Moschus, Tragulus, Oryoteropus, Ailurus, and some other Mammalia, with Historical Notices," by Mr. G. Gulliver.
Royal Institution, 3 p.m. "On Chemistry," by Prof. Odling.
London Institution, 7.30 p.m.
Society of Antiquaries, 8.30 p.m.
Royal Society Club, 6 p.m.
Brighton and Sussex Natural History Society, 8 p.m. "On Seeds," by Mr. T. W. Wonfor.

FRIDAY, 11th.

Royal Institution, 8 p.m. "Temperature and Animal Life of Deep Sea," by Dr. Carpenter.
Royal Astronomical Society, 8 p.m. Anniversary Meeting.
Quekett Microscopical Club, 8 p.m.
Clinical Society, 8.30 p.m.
Hunterian Society, 6 p.m. Dinner. Prof. Owen in the chair.

SATURDAY, 12th.

Royal Institution, 3 p.m. "On Meteorology," by Mr. R. Scott.
Royal Botanic Society, 3.45 p.m.

MONDAY, 14th.

Royal Geographical Society, 8.30 p.m.
Society of British Architects, 8 p.m.
Medical Society of London, 8 p.m.
London Institution, 4 p.m.
King's College, 8 p.m. Prof. Guy's Lectures.

TUESDAY, 15th.

Institution of Civil Engineers, 8 p.m.
Pathological Society, 8 p.m.
Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.
Anthropological Society, 8 p.m. "Aborigines of the Chatham Islands," by Dr. Barnard Davis and Mr. A. Welch. "Polygamy," by Dr. John Campbell. "Inscribed Stone from Venezuela," by Mr. R. Tate.
Statistical Society, 8 p.m. "On International Coinage, and the Variations of the Foreign Exchanges during recent years," by Mr. Ernest Seyd.
Leeds Philosophical and Literary Society. "On the Sewage Question," by Edward Filliter, M.Inst.C.E., F.G.S.

WEDNESDAY, 16th.

Society of Arts, 8 p.m. "On Emigration," by Thomas Plummer, Esq.
Royal Society of Literature, 8.30 p.m.
Meteorological Society, 7 p.m.
Royal Horticultural Society. Exhibition of Chinese Primulas and Lycastes.

Royal Horticultural Society.—The corrected dates of meetings shall appear in our "Diary" in due course. We thank the secretary for the courtesy shown us.

Bristol Naturalists' Society.—The secretary is thanked. He misdirected his parcel.

H. W. G.—Baumé's degrees express the strength of spirit of wine in parts per hundred. Thus, spirit of 90° Baumé contains 90 per centum of absolute alcohol. For general purposes you can obtain alcohol of the particular strength by digesting rectified spirit with good dry pearlash for a day, then decanting the alcohol from the aqueous solution of the pearlash which is thus formed, and distilling.

The late Mr. Walsh.—"C. Y. R." will see by our last number that we have anticipated his request.

"M. T. M."—Thanks for his interesting letter and kind consent.

"J. H."—We cannot oblige our correspondent. Probably one of the sporting papers would be ready to insert a note of the kind for him.

New Subscribers shall have the handbills sent to him for distribution, as he wishes. We could desire a multiplication of the same zeal in our behalf in other directions, on the part of those who estimate justly the usefulness of Scientific Opinion as a special organ. We hope "A. A. B." will be rewarded in what he may himself accomplish among his own friends, and further by many others following his example.

NOTICES.

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With a view to meet the extending requirements of our Readers, we have permanently enlarged Scientific Opinion, *and have introduced various improvements suggested by the experience gained during the production of the first two Volumes. May we ask Subscribers to remind those of their Scientific friends who are not already in the habit of regularly purchasing* Scientific Opinion, *that the commencement of the present Volume presents a very favourable opportunity to intending Subscribers.*

WEDNESDAY, FEBRUARY 16, 1870.

THE DISMISSAL OF LEVERRIER.

THOSE who have been unfamiliar with the recent progress of events at the Observatory of Paris must have heard with surprise that the great astronomer Leverrier, whose name has been thought to give dignity to his title of Imperial Astronomer rather than to be adorned by that addition, has been summarily dismissed from his position at the head of the Paris Observatory. Though there are many eminent astronomers and mathematicians in France, Leverrier stands fairly in advance of them all. Matched only in fame as respects his special department of astronomy by our Adams, and holding a position as respects astronomy generally side by side with Adams and Sir John Herschel (no others must be ranked with them), Leverrier seemed safe in his position as the recognized head of astronomy in France. Yet even those who are most sensible of the wonderful talents of the distinguished Frenchman admit that he has fairly earned his dismissal.

It has been for a long time obvious to all who understand what the working of a scientific department should be, that there has been a hitch in the arrangements at the Paris Observatory. Now one indication, now another, has exhibited the existence of ill-feeling between the head of the Observatory and the able corps of mathematicians working under him. It had come, indeed, to be well known in many quarters that Leverrier's treatment of his *quasi*-colleagues, as well as of his recognized subordinates, was simply unbearable. To a general —sometimes a very particular—brusqueness of manner was added a jealousy respecting the work and the reputation of others which a man in Leverrier's position should have been the last to feel. It was not to be expected that such men as Wolf and Loewy, Marié Davy and Villarceau, would quietly submit to be treated like misbehaving children, still less that they would consent to be hampered by absurd restrictions in the discharge of their several functions.

The matter had, indeed, reached such a point that even had the *chefs de service* and the *astronomes adjoints* been willing in the interests of Science to endure the treatment they were exposed to, they would have been compelled to act by the reproaches of those who mistook their devotion to Science for tameness of spirit.

Under such circumstances, but one course remained open to them. A memorial was addressed to the Minister of Public Instruction, in which the condition of the Observatory and the way in which the affairs have recently been administered, were discussed at full length. This memorial was signed by Villarceau, Loewy, Wolf, Marié Davy, and all the subordinate officials of the Observatory without a single exception; and the memorialists left with the Minister of Public Instruction the option of dismissing M. Leverrier or of accepting their resignation.

It was felt by the French Government that, in the face of such an appeal as this, even the eminent abilities and the high standing of the Imperial Astronomer must be disregarded. After a very brief consideration, the complaint of the memorialists was responded to by the dismissal of Leverrier from the public service.

Much as we may regret that such an astronomer should no longer have at his disposal those facilities for useful work which Leverrier derived from his position as director of the Paris Observatory, there can be no doubt that his dismissal is a gain to Science. It is a gain, because the astronomer who will replace him, though he may be less eminent in science, will be more careful of the interests of Science. It is a gain, because those who have been under his control will feel that they must justify their action by showing that the progress of astronomy really has been checked by his misconduct. But most of all, it is a gain, because it reminds those who hold a similar position to that which Leverrier has lost, that what is expected from them is the encouragement of Science. If now, or at any future time, there should be an astronomer, however distinguished, who, having attained to a position of authority, should be disposed to exercise his powers unwisely, to be overbearing and ill-conditioned with his subordinates, jealous as to the progress of their labours, or more careful in any way of his own reputation than of the interests of Science, to such a one the history of Leverrier's fall will be a profitable subject of study.

So far as Leverrier is personally concerned in this matter we have little further to say; but as respects the bearing of the event on his fame as an astronomer we may be permitted a few words of comment. We believe that when a place is to be assigned him in the list of those who have laboured in advancing astronomy, the unhappy circumstances which have just occurred will be wholly left out of consideration. It will not be of Leverrier, the director of the Paris Observatory, that men will think—but of Leverrier, co-discoverer with Adams of the giant but invisible mass of distant Neptune. Men will remember that if it was given to our own great astronomer to seize as by inspiration upon the true interpretation of a great problem, and to complete while yet but a youth the splendid solution of its perplexities, Leverrier achieved the more arduous task of tracking out one by one every possible interpretation, of giving the just reasons for rejecting each, and (when he alone had thus at length proved where the true interpretation was to be looked for) of carrying the analysis of the problem to a solution as satisfactory as that achieved by his English fellow-worker. Nor will it be forgotten how successfully Leverrier has laboured in other branches of mathematical astronomy; how, having settled the details of the outermost limits of the solar system, he dealt next with the motions of the innermost of all the known planets; how skilfully he has tabulated the motions of Mercury, Mars, and Venus; in fine, how ably he has achieved every scientific task to which he has devoted his splendid talents.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

MR. FLOWER, the new Hunterian Professor of Comparative Anatomy in the Royal College of Surgeons, opened his course of lectures on the Mammalia on Monday. The lecturer's remarks were chiefly introductory, but were nevertheless of peculiar interest. The manner in which Professor Flower confirmed the truth of certain of Mr. Darwin's views gave especial pleasure to a large number of his audience.

WE are informed that Mr. Pritchard has obtained the Savilian Professorship of Astronomy.

No class of the community would feel the advantages of reduced rates of postage on printed matter more than would scientific men; while at the same time none can demand it more fairly than they on the grounds that in thus undoubtedly aiding the progress of their investigations the country at large will be the real gainer. We hope, therefore, to see every scientific worker giving what aid and influence he can to the Committee of the Society of Arts now sitting, appointed to take steps for urging upon the Cabinet the great importance to all classes of reducing the postage on printed matter to one

halfpenny, instead of a penny as at present, for every four ounces weight. Printed matter abroad is carried at very much lower rates than in this country, to the great benefit of the community. Circulars, newspapers, and books, and even small parcels, are transmitted by the post in foreign countries at rates which should put Englishmen to shame. The Government, last session, expressed itself favourable to a reduction of the rates, and the Post Office officials, it is well known, are quite ready to undertake the service: so that the chances of success are great if the matter be earnestly worked.

Last week Earl de Grey, after distributing the prizes to the successful competitors among the members of the evening classes of the Birkbeck Institution, made special comment on the fact that almost from the commencement of the institution classes had been held for scientific instruction. He said he thought it was impossible to overrate the importance of such instruction, the great value of which had only lately been realized by the country at large.

Colonel Milward, R.A., has been appointed superintendent of the Royal Laboratory at Woolwich Arsenal. The office of Deputy-Director of Ordnance, previously held by this officer, will be abolished.

According to the *Athenæum*, Colonel Walker has drawn up, at the suggestion of the Astronomer Royal, a report on the observatory at Madras, pointing out a way in which that establishment may be more advantageously employed than of late, and prescribing certain definite duties which might there be undertaken.

A memorial was presented by a deputation to Earl de Grey and Mr. Forster, setting forth the hardships of the new orders in reference to the system of State aid to Science classes. The chief points urged were that the changes in the *Science Directory* before the year had terminated for which the directions were issued, were not only an inconvenience, but were looked upon by the teachers as a breach of faith by the department. The working of the changes, especially with regard to teachers, was shown to be a peculiar hardship upon the teachers of small classes, and details of the hardships were given by a reference to instances occurring in the classes connected with the union of Lancashire and Cheshire mechanics' institutions. It was stated that while one class teacher might benefit, another would lose remuneration by the change; for instance, the teacher of chemistry might gain, but the teacher of mathematics would lose. It seems to us that the memorialists have a real grievance, and we hope to see it redressed.

In a letter to the daily press, "one of the deputation" from the British Association to the Privy Council points out some of the data desirable to be obtained before any remedial measures are attempted for advancing either scientific research or scientific instruction. According to him some of these data "may be thus shortly enumerated. What is now being done in the way of Science in England? Who is doing it? Who enables them to do it? To what extent, and how, does the State contribute to Science? What return for its contributions is obtained by the nation? Is the return insufficient in any particular instance? If so, what is the cause—neglect of duty on the part of those receiving the public funds, or inefficiency of organization on the part of the State? Should the State assist Science at all, even to the present limited extent? Should it give more assistance, or less, than at present? If more, how may the aid be best rendered—by grants of money, by rewards for scientific merits or discovery, by supplementing existing institutions, whether private or public, by founding new institutions? Under what particular departments of the State are the various institutions now placed? How is responsibility to the nation in each separate case provided for? How is scientific patronage at present dispensed? Is it, or is it not, desirable that the whole scientific system of the country (when we have a system) should be placed under one and the same department? Have we at present any department fitted to assume the charge? I do not think," he says further, "I am rash in declaring my belief that there does not exist a man in England who can give a clear, accurate, business-like answer to any three of these questions. Possibly we might get answers to all by extracting a bit from one man and a bit from another; but who is to find the right men to question? Who is to force them to answer truly? Who is to devote the necessary time to the inquiry? Clearly no individual can do this. But a Royal Commission can do it. Is there any other mode of obtaining this information better than that which a Royal Commission would afford? If so, by all means let us have it. If not, let us have a Royal Commission."

According to the *Medical Times and Gazette* the scheme for amalgamating the Medical Societies is likely to break down, a good deal of passive opposition having been exhibited to the propositions of the Medical and Chirurgical Society.

In connection with Mr. Alexander Wallace's article on Silk Culture in England, which recently appeared in Scientific Opinion, the following announcement is of interest. At the last meeting of the Committee of the Silk Supply Association at the offices of Mr. D. Chadwick, M.P., reports forwarded by the Colonial Office from silk-producing colonies were read, showing that the production of silk may be almost indefinitely increased. It was unanimously considered that the importation of cocoons to this country and the reeling here would introduce a new industry of considerable importance. Mr. Chadwick gave an account of his visit to Peterson, the principal seat of the silk manufacture of the United States, and of his conference with the Chamber of Commerce, New York, on the subject.

The Pharmaceutical Society have issued a copy of the Regulations required by the Pharmacy Act, 1868, to be observed in selling by retail, and in dispensing, poisons.

Sir Edward Sabine, as President of the Royal Society, has sent out cards for two evening receptions, which are to be held at Burlington House on March 5th and April 23rd.

Mr. Solly, F.R.S., has been appointed Hunterian Orator at the Royal College of Surgeons for the ensuing year.

A supplement to Watts's *Dictionary of Chemistry*, which will bring the record of chemical discovery down to the end of 1869, is preparing for publication.

The first order made by Government under the Sea Fisheries Act of 1868 has been granted by the Board of Trade to the Corporation of Boston, Lincolnshire, investing them with conservancy powers over the extensive oyster and mussel fisheries lying between Boston and Lynn Deeps. By its provisions a close season is established for three months of each year, portions of the fishery may be entirely closed from time to time, small oysters and mussels are to be thrown back, and all boats fishing the oyster or mussel beds are to pay a license-duty, which will be applied to cultivating and improving the fisheries.

The meeting of the Royal Agricultural Society in 1871 will probably be held in Shrewsbury.

In outward appearance no two ships could well be more dissimilar than the two turret-ships, the *Monarch* and the *Captain*, which arrived last week at Plymouth. The *Monarch*, as the representative of the high freeboard type, carries her turrets on a deck elevated at an unusual height from the water, and thus offers in her lofty sides an immense and weakly-plated target, as compared with the penetrative power of her own guns, for an enemy's shot. With a low freeboard, and therefore offering a much lesser target, the *Captain* has greatly the advantage of the *Monarch* in this respect. The speed of the *Monarch* under steam has been established beyond dispute, as has also her excellence as a sea-going ship, and steadiness as a

floating gun-carriage, in all weathers. The *Captain* has yet to prove her qualifications in speed, behaviour at sea, and steadiness as a gun-platform; but the trials to which she will be subjected in company with the *Monarch* will give a true measure of value in all these respects. During the short time available for obtaining any experience relative to such matters as in the voyage round from Birkenhead to Portsmouth, the *Captain's* performances gave promise of equalling in all respects in the future those of her handsome rival, the *Monarch*. Being, as they are, competitive ships, it is impossible to speak of one without the words made use of having some reference to the other, and in this way, in fact, the comparative merits of the two become most interesting; and one of the first problems to solve in the coming competitive trials will be—What are really the comparative advantages and disadvantages of a high and a low freeboard to a turret-ship when fighting an action with an enemy in a gale of wind in mid-Atlantic? All other questions beyond this must sink into insignificance when ocean-cruising turret-ships are considered simply as fighting machines.

A CHEMISTRY class is being formed at the Technical School, Clerkenwell.

THE greatest rainfall of any twenty-four hours this five years fell between 2 p.m. on the 6th to the same hour on the 7th inst., according to Mr. Billington's observations. On the 10th inst. the mean temperature was 14·9° below the average of fifty years: so we learn from Mr. Alnatt.

MR. GRANT DUFF, M.P., was elected Lord Rector of the University of Aberdeen on Saturday.

YESTERDAY week, Mr. Cross, of Liverpool, received a large importation of serpents and other animals. Two boa constrictors, whilst in a dormant condition, measured 8 ft. and 10 ft. in length, and one of the pythonesses, whilst on the voyage from the West Indies to Liverpool, gave "birth" to no fewer than 35 pythons—all of which, notwithstanding they were inclosed in a box not larger than an ordinary Foyle salmon-case, were in good condition on being sent ashore. There were also two blue-faced gorillas of the largest kind, a buffalo, a blue maccaw with gold-fringed eyes, a griffin vulture, and a porcupine rat—the only one that has ever been imported from the West Coast of Africa. During Tuesday night one of the large serpents burrowed from under its cage, or in some other way managed to escape, and gained access to an adjacent stable through a hole in the wall. On Wednesday morning, when the carter entered the stable, he observed that a horse there was unusually timid and nervous, and on closer examination he noticed that its back was marked as if beaten with a thong. Presently he observed the body of the serpent suspended as it were from the manger. It was quite dead; a portion of the head had been bitten away, and the lower part of the body, which rested on the ground, bore the marks of having been trampled by the horse's shoes. The horse itself was uninjured.

THE Aurora borealis is reported to have been visible on Friday evening at Cambridge, at half-past eight, as a long, low arch of pale light spanning the northern heavens, and surmounted by a glow of rosy red, which flushed and flickered and faded away every moment. On its final disappearance its place was occupied by a bright band, of varying intensity but definite shape, of which, however, only portions were visible at once.

IN connection with the subject of railway communication between this country and the Continent, to which we some time since called attention, an interesting letter has appeared in the *Times* from Mr. J. Fowler. The writer advocates the employment of large ferry-boats, so constructed that their motion will be practically unaffected by the waves of the English Channel, and that the whole train and carriages from London may be run upon their deck, carried over to France, slid upon the French line, and so on to Paris without change or annoyance to the passengers. These boats Mr. Fowler thinks should be about 450 ft. long, proportionally wide, and with a draught of about 12 ft. It is, he says, objected that the weight of the train would make the boat top-heavy, but this is a complete mistake. A train of passenger carriages would only weigh about 120 tons, which, in the proposed vessel of 7,000 tons, would be practically unfelt. It is a common idea that it is proposed to place the passenger carriages on the deck, exposed to wind and weather, instead of their being enclosed, as they will be, in a space between the upper and the main deck, and completely protected from exposure. It is also intended to carry the goods trucks below the main deck, as their weight will be useful to ballast the vessel and increase its steadiness. On the main deck, accommodation will be provided for passengers (who will generally alight from their carriages, as they would at any railway station where a stoppage is made for refreshment), and they will find well-lighted, well-warmed saloons, with means of reading, writing, &c., which will make the sea voyage the most agreeable part of the journey. Private cabins will also be provided on the same deck, and large rooms for the officials of the Custom-houses of the two countries, so that all luggage may be examined and the weary delay from that cause at the end of the journey entirely avoided. The speed of these steamers is an important part of their design, and instead of the journey from Dover to Audresselles occupying two hours, as stated by your correspondent, it will be performed in one. The hydraulic apparatus in the harbours on each side is so arranged that the transfer of the carriages between the railway and the boats will be effected within five minutes.

M. GUSTAVE LAMBERT has been journeying about endeavouring to complete the sum necessary for the proposed Polar Expedition. The result is that about £4,000 are still wanting to enable it to be undertaken.

ON MICROSCOPIC ACCESSORIES.

BY J. BAKER EDWARDS, PH.D., F.C.S.,

Hon. Sec. Montreal Microscopic Club, and Cor. Mem. Liverpool Microscopical Club and New York Microscopic Society.

NEXT to the possession of a good, solid, smoothly-working stand, with good powers and good illumination, is the desire for the acquisition of those useful accessories which the zealous microscopist soon finds are essentials to his progress in practical study. Of these I shall first notice simplifications which amount to permanent improvements. Thus, the shutter or graduating diaphragm is an improvement likely to supersede the rotating diaphragm beneath the stage; and the adjusting side-light as a parabolic reflector is a useful substitute both for the bull's-eye condenser and the various Lieberkuhns. The orthoscopic eye-piece, in its double service as an achromatic condenser, is also a valuable and economical accessory. I have already stated that the binocular prism is an essential to the best form of stand, and is entitled to a higher place in the estimation of the working student than a mere accessory.

The new rotating glass stages of either Messrs. Crouch or Collins are certainly accessions to the instrument, and can be recommended to those who do not care about the expensive mechanical stage. The movement is smooth and true, and the fingers may soon become educated so as to work the object with all the precision desired.

A rotating diaphragm, furnished by Crouch or Collins, also gives all the effects of the dark well and oblique illuminations.

The parabolic condenser of Wenham is an invaluable illuminator for foraminifera, polycystina, and transparent injections.

The camera lucida, lever compressorium, and object-glass reflectors may, I think, be considered as luxuries, not at all

essential to the student. So also the "erecting eye-piece," although invaluable under exceptional circumstances, may be generally dispensed with, as, for ordinary dissections, the binocular folding stand, called the "Collins's Lawson Dissector," holds the preference.

Every real student should procure at least a stage micrometer, and he will probably not regret the possession of a "cobweb ditto" for the eye-piece. Accuracy in the expression of the size of objects described is often of the greatest importance in original investigation.

Must I call the "Brŏok's nose-piece" an accessory? I suppose I must; yet I am accustomed to regard it as one of the most essential parts of my instrument. So valuable is the ready exchange of two object-glasses that it is almost essential where high powers are often used. I may here state, incidentally, that I have tried the multiplication of this rotatory movement to the extent of three and five object glasses, but have found that the strain and leverage upon the fine adjustment is too great, and therefore prefer the double nose-piece.

The polariscope is an essential part of a good microscope. It cannot be dispensed with, and should therefore not be deemed a mere accessory. Still, it often is so called, and various contrivances have been suggested to reduce its cost. I should recommend, however, large prisms and thin selenites, and would by no means advise any experiments with tourmalines or Herapathites. I have tried them, and find no polariscope is so satisfactory as the Nichol's prism, with a good selenite below the object, the analyzer being placed immediately behind the object glass. In the Harley Collins' microscope the arrangement is excellent; the same slide carries the analyzer and the binocular prism into the body, thus saving a great amount of screwing and unscrewing.

I would urge upon the microscopist the importance of this mode of illumination, as it frequently gives valuable delineations when least expected. Objects required for investigation, such as parasites and tissues, are often obscure and unsatisfactory by ordinary modes of illumination, owing to their great transparency. In these cases, polarized light is of the greatest assistance in the delineation of structure.

Some confusion exists in the popular mind as to the comparative value of the polariscope and a mode of illumination introduced by Mr. Heys, of Manchester, of a very different character, called the kalescope. By passing the rays of light through the bull's-eye, obscured by a coloured glass, and through the condenser below the stage, through a diaphragm of various coloured glasses, Mr. Heys obtained brilliant fields. Opaque objects are thus illuminated with bright lights of different colours, and are tinted with fringes of considerable beauty and delicacy. But such an illumination affords no information as to the real nature of the object, for these tints are as artificial as those which fall upon the faces of people in church from an oriel window; the colours may be beautiful, but they certainly do not improve the complexions of the worshippers; and as a microscopic accessory, the kalescope is a mockery, a delusion, and a snare.

The Sorby micro-spectroscope is a specialty which appeals only to the chemist or toxicologist. The live-box and the zoophyte-trough are necessary accessories to the naturalist, and will afford ample return from the employment of several forms of them.

I do not think it necessary to enter into the merits of those contrivances which are invented for the mounting and preservation of objects; but, in the above short sketch, have endeavoured to give my experience as to the necessary desiderata for the working student.

The most complete working instrument that I have yet seen is the Harley Collins' binocular, with its appurtenances, and I doubt whether anything can be obtained of greater working value for the moderate price of $100. I shall, therefore, conclude with a detailed description of it:—

A compound binocular body, with two sets of eye-pieces and eye-shades; neutral-tint reflector for camera lucida; rotatory glass stage, with lever movements; shutter to body to carry polarizing and binocular prisms; Brook's double nose-piece; 1 in. and ¼ in. object glasses (good); a wheel of side-light diaphragms, stops, and adjusting shutter diaphragm; achromatic condenser, polariscope and double mirror; side-light reflector, and bull's-eye; together with a good mahogany box, and packing for the apparatus.

In conclusion, I would recommend a good selection of "accessories" in preference to a long series of "object glasses;" but I am satisfied that the ingenious student will contrive many of these without the aid of the optician. I have endeavoured herein to indicate the most profitable investments, leaving many excellent inventions unnoticed; for a description of such in detail, let the reader consult the last edition of *Carpenter on the Microscope.*—*The Canadian Naturalist.*

THE PRESERVATION OF IRON.

BY PROFESSOR HENRY E. COLTON.

"WHAT is wanted is something equally applicable to large or small pieces of iron, and which will answer to ward off the attacks not only of the common atmospheric oxygen, but also remain unaffected by acids or salt waters."

The above, from a late number of the *Scientific American*, states not only the writer's ideas, but also one of the greatest wants of the age. Iron is daily being put to more and more varied uses. On land the great question is what will prevent rust; on water, what will prevent rust and fouling of bottoms of iron vessels. We will briefly summarize the many patents granted for this purpose.

Eight are for sheathing of various kinds put on in varied modes. The most practicable of these is a system prepared by Daft. Most iron vessels are now constructed by every other plate lapping the edges of the one between. He proposes, instead of having the plates all the same width, to have one wide and one very narrow plate. This would leave a trough between the two wide plates of the depth of the thickness of the plates. He proposes to force into this trough very tightly pieces of teak, and to the teak, thus imbedded, he nails a sheathing of zinc. The zinc is kept clean by slowly wearing away of its surface from action by contact with the iron and salt water.

There are four patents, in which various, so-called, non-conducting coats are put on the iron, and copper pigment in some form put on over them. These have been specially condemned in England, as no matter how good the non-conducting substance—and many are so only in name—it will become rubbed off at some points, and there the bottom will be eaten both by salt water and action of copper.

Coal-tar and asphaltum are the subjects of patents in various forms.

One patent claims rubber or gutta-percha dissolved in linseed oil as a vehicle in which to grind the pigment; another the same dissolved in naphtha or bisulphide of carbon as a pigment; another hard rubber, ground.

Enamelling with different materials is proposed by some, while one proposes to glaze the bottoms so that barnacles and grass would find a slippery foothold.

Combinations of tallow, resin, and tar—mineral and pine—are patented mostly to use over other paints.

Coal tar, sulphur, lime, and tallow are the subject of one patent; guano, red lead, and oil of another; while sulphur and silica are claimed by a third.

Paints containing mercury, arsenic, and even strychnine are the subjects of several patents. A mixture of coal tar and mercurial ointment of one.

Galvanism is proposed to be used in various ways—strips of

copper and zinc, or by galvanizing the plates before use. Black lead finds a place in many compositions.

One patent, by a complicated process, effects a union of metallic zinc and iron; this, granulated and ground fine, then mixed with red lead and oil, makes the paint. It is said to be the best of all the patented stuffs.

It is astonishing how many use oils derived from coal, peat, or resin, and tars of the same.

There are about fifty patents for this object, and with all of them before their eyes, the British Society for the Advancement of Art still hold the $5,000 reward for a pigment or covering which will perfectly protect from rust and fouling. However they may puff their products for selling, no one has the temerity to claim that they deserve the reward.

We think it would be difficult to find so many expedients ever before adopted for the accomplishment of any one object. These are all English patents, England having necessarily been obliged to use iron for vessels from its cheapness as well as its consequent first introduction there. In the United States no patents worth mentioning have been granted.

The first requisites for a pigment or coating for iron are, that it should not contain any copper—the corrosive action of that metal on iron being intense. Then if for work exposed to air it should form such a coating as to be impervious to that gaseous fluid, and be so constituted chemically as not to be oxidizable by it; if under water—especially sea-water—to be impermeable to moisture, so elastic as not to crack, so insoluble as not to chloridize; to form a perfect, apparently hard, coating, and yet wear just enough to keep off incrustation, barnacles, or growth of grass. In fact, this slow wearing away is the only preventive of fouling in iron vessels. Wooden bottoms may be poisoned by solutions of copper—and that metal has no superior for such uses, especially when it is combined in mixture with mineral or resinous tars and spirits—these compounds, however, are not only useless on iron bottoms, but also injurious. What then is *the* substance:—1st. One of the oxides of lead (red lead). 2nd. The purest oxide of iron to be found. If properly made these articles can be carried to no higher state of oxidization, and respectively, as to order named, they have no superiors for body and durability. By preference, 1st, red lead, either out of or under water; 2nd, Prince's oxide of iron only, out of water. The colour of these paints—the first red, the latter brown, may be hidden by a coat of white or tinted colour. If there were to be had in combination as a white paint, an oxide of lead and an oxide of zinc, it would be immensely superior to either; but that such has not been produced is rather the fault of carelessness than of possibility. Zinc protects iron with great effect, but it is too rapidly worn in the effort to be of lasting value. Hence the great desideratum, the yet to be, the coming pigment, is a white oxide of lead, or a combined white oxide of lead and white oxide of zinc, without sulphates or chlorides.

Those materials answer very well for work exposed to atmospheric air, and perhaps nothing will ever be found better; but a different need is that for salt water. No mere protector of the iron from rust can be found superior to pure red lead and linseed oil. We have seen a natural combination of zinc, lead, and iron, which, in our experience, ranks next; but the zinc is acted on by the chloride of sodium, and wears away too much of the material. Red lead, however, while covering the iron perfectly, and effectually preventing rust, and also having but little disposition to chloridize, when it does, will foul both with grass and barnacles. Hence, the first desideratum being obtained, how shall we accomplish the other? The prevention of fouling may be accomplished in two ways:—First, cover the vessel's bottom with two or even three coats of red lead, and give each time to dry hard. Then melt in an iron pot a mixture of two parts beeswax, two parts tallow, and one part pine resin; mix thoroughly, and apply hot one or two coats. This mixture may be tinted with vermilion or chrome green. It is not necessary to use any poisonous substance, as it is only by its softness and gradual wear that it is kept clean. Second, mix red lead and granular metallic zinc, ground fine, or such a mineral as we have mentioned—crystalline and granular in its character. Put on two or three coats, and allow each to set—they will never dry hard. The zinc will slowly wear off, keeping the whole surface clean, while there will be left enough coating of the lead to preserve the iron from rust. The oil I would urge for these pigments is linseed—as little boiled as possible, to be thinned with spirits of turpentine. There seems to have been a mania for mixtures of tar and resins, their spirits and oils; my experience fails to show me any advantage for them on an iron bottom. They have neither elasticity nor durability, while linseed oil has both in a pre-eminent degree, and is no more likely to foul than they, when in a combination that does not dry hard. Besides, they are difficult to grind, inconvenient to transport, and offensive to use.

Perhaps we have not, in the opinion of some, answered the want expressed in the first paragraph. No pigment with the requisites of durability and cheapness will resist the attacks of strong acids on iron. The first we have mentioned will—all such as may float in our air from factories or chemical works. Chemically, it is converted by nitric acid and chlorine into an insoluble substance—plumbic acid or the cyanide of lead. An experience of more than three years, with almost unlimited means at our command for experiment, demonstrates to us that we have indicated the means of filling the other requisites asked for. It may be that something new will be discovered, but we doubt it. Let any one tread the road we have trod, investigate and experiment where and as much as we have, and if that place is where we have not, their experience will be the same as ours.—*Scientific American.*

COAL-TAR AND ITS PRODUCTS.

BY EDMUND J. MILLS, D.SC., F.C.S.

THE history of coal-tar and its products is not only interesting as a chemical romance, but as furnishing a striking example of the practical utility of pure or abstract research. Within the memory of many of us, tar was a repulsive nuisance—

Ἀχρεῖον καὶ παράορον δέμας—

which had sometimes to be stealthily removed at night, under apprehension of legal proceedings. It is now, if not the king, certainly the viceroy of manufactures; it has suppressed and created whole branches of industry, and seems still to be unexhausted as a source of products, the extrication of any one of which may affect the prosperity of large sections of labour. I purpose, therefore, to give a brief account of this remarkable body, and of the nature of such of those substances as have been derived from it and are actually the subjects of art utilization. It will be necessary to commence with some considerations as to the nature of coal itself. Coal, as is well known, consists principally of carbon, an element of which the diamond, graphite, and lamp-black are almost wholly composed. Nor can there be any doubt whatever that this carbon has been eliminated, by some slow process, from vegetable structures. The chemical changes involved in this transformation are not quite so clear as might be desired; but there seems good reason to suppose that they chiefly partake of the nature of what is known in pure chemistry as "condensation." The meaning of this will be evident if we take as an illustration *cellulose*, a substance which abounds in all plants, especially those of rapid growth, and must have been itself principally concerned in the genesis of coal. Let it be assumed that cellulose ($C_6 H_{10} O_5$) resembles most other complex organic bodies possessing alcholic functions, and the following results must ensue on the protracted application of a gentle heat, especially if aided by pressure. The cellulose will *unite with itself*, and at the same time part with

the elements of water, $2[C_6 H_{10} O_5]$, becoming $C_{12} H_{18} O_9$ and losing $H_2 O$; the same will happen to the body $C_{12} H_{18} O_9$, which will become $C_{24} H_{34} O_{17}$; this, in its turn, will be transformed into $C_{48} H_{66} O_{33}$; and so on. Now, let us compare the percentage composition of cellulose, with which we started, and that of the derivative $C_{42} H_{66} O_{33}$. The numbers are as follows:—

	$C_6 H_{10} O_5$	$C_{48} H_{66} O_{33}$
Carbon	44·4	49·2
Hydrogen	6·2	5·7
Oxygen	49·4	45·1
	100·0	100·0

At this, the third stage of the process the gain in carbon is 4·8 per cent., while the loss of hydrogen is 0·5, and of oxygen 4·3 per cent. It is evident, then, that by continuing an action of this kind we should eventually obtain a product, consisting of carbon and a very small quantity of hydrogen; it would undoubtedly be black; and altogether very similar to coal. The formation, then, of coal can be accounted for without deserting well-known results of theoretical research.

Coal contains, in addition to carbon and hydrogen, small amounts of sulphur, phosphorus, nitrogen, oxygen, iron, and other mineral matters, and most of these have a direct influence on the nature of the tar.

If pure carbon were heated alone, either in a vacuum or in presence of some gas which is without action upon it, nothing more would happen than a change of density one way or the other. When, however, coal is heated under the same circumstances (or in a close vessel, kept as full as possible, such as a gas retort) it loses weight, giving off a mixture of gas and vapour, and leaving a residue which is known as coke. The mixture of gas and vapour, if passed through a series of cold vessels, as is the invariable practice, deposits tar, the quantity of which is smaller as the heat applied to the retort was greater; while the gas passes on and is used for illuminating purposes. It deserves to be mentioned, however, that in the manufacture of coke, the whole of the volatile products are generally permitted to escape,—an instance of negligence and bad economy which deserves the severest reprehension.[1] Coke retains the whole of the purely mineral constituents of coal, and very minute portions of the more volatile bodies above named; of these, however, the sulphur not unfrequently rises to 0·5 per cent.—enough to cause the use of coke as a fuel to be very prejudicial to health, unless there is a strong draught to carry off the products of combustion.

Tar, as has been indicated, is the result of a process of destructive distillation carried out in iron or clay retorts, which are kept as fully charged as possible, and preserved from the entrance of atmospheric air by some simple contrivance. In the manufacture of gas, it is an object to avoid the formation of tar as much as is practicable; accordingly, a dry coal ought to be selected, and heat should be applied to the retort as rapidly and as strongly as is allowable. But as the mass in the retort does not readily conduct heat, it follows that much of it is necessarily subjected to only a slowly increasing temperature,—a condition which involves the formation of tar. Gas, then, and tar in a state of vapour, leave the exit-tube of the retort together; the latter is separated in a cooling-tank, and, when it has acquired sufficient volume, is offered for sale.

What is it that really happens in this distillation?

The careful investigation of a large number of the constituents of tar, which has been made by many different chemists, furnishes a clear and very beautiful answer to this question. Just as the conversion of cellulose into carbon, in which, as has been pointed out, lies the whole secret of coal-formation, is a process of "condensation"—that is, of producing a complex from a simple body, according to a known law—so the conversion of coal into gas and tar is a process whereby a complex material is split into a number of much simpler components. Of this we may feel certain, even though the mode of decomposition and simplifying cannot be so exactly formulated as in the previous case. It is interesting, also, to notice that the various chemical products obtained exhibit every grade of complexity,—from hydrogen (H_2), for example, to compounds of even higher order than the crystalline anthracene ($C_{14} H_{10}$).

The general nature of the distillate can now be deduced from that of the coal itself. While some of the oxygen and hydrogen of the coal must unite to form water, there must also be formed bodies of increasing complexity that are analogous to water. Examples of these are to be found in the alcoholic class, of which phenol (carbolic acid), cresol, and phlorol, are members. Again, the nitrogen and hydrogen of the raw material combine, on heating, to form ammonia; but ammonias of much importance are also found, exhibiting various grades of intricacy, but all preserving the common function of neutralizing hydric chloride (hydrochloric acid), just as ammonia does. Aniline and pyridine are instances of these. Lastly, carbon and hydrogen, besides giving rise to their lowest possible compound (marsh-gas, CH_4), under these circumstances originate at least two converging series of hydrocarbons, all of which closely resemble it. Phenylic hydride (benzol) and caprylic hydride are illustrations of the two groups respectively.

Among the special constituents of tar a few substances deserve to be noticed as possessing an incidental interest. These are—hydric cyanide (prussic acid), hydric sulphide, or sulphuretted hydrogen (found in combination with ammonia), and hydric acetate (acetic acid). As the quantity of oxygen in coal is generally very small, we cannot expect to meet with a great variety of its compounds in the products of distillation; accordingly, when we have added to the alcoholic bodies previously alluded to, the sulphuric oxide known as sulphurous acid, and carbonic dioxide ("acid") and hydric acetate, the list is probably complete.

When the tank in which the tar has collected is examined, it is found that a rough sort of separation of the ingredients has already taken place, the liquid having divided itself into two masses, or layers, one of which is watery and the other oily. It will be convenient to discuss these, in the first place, apart.

Constituents of Aqueous Layer.—The most important constituents of the aqueous layer are the ammonia and ammoniacal salts which it holds in solution. The chief of these are the carbonate, sulphide, and sulphocyanide. In order to utilize the ammonia, the watery liquid is, in one process, pumped into large shallow vessels, and there mixed with excess of hydric chloride. In this manner all the ammoniacal salts are decomposed, and sal ammoniac, impregnated with a dark colouring matter, settles to the bottom, insoluble in the acid fluid. Meanwhile, much heat is evolved and sulphuretted hydrogen is given off in not unfrequently dangerous quantities, intoxicating and stupefying the workmen. When the sal ammoniac has thoroughly cooled and settled, it is taken out and dried, or else evaporated to dryness, directly in contact with the whole fluid. In either case the crude dry salt has to be sublimed several times, in pots specially designed for the purpose, before it has entirely lost its colour, and is fit for the market.

It is not, however, always the case that sal ammoniac is desired. In the alum manufacture, for example, ammonia alone is requisite, and is applied in the following way:—When the mixture of aluminous earth and oil of vitriol (the starting-point in the preparation of alum) has been heated to about 110° C., the vapours from crude boiling gas-liquor are passed into it. But as mere ebullition does not extract the whole of the ammonia from the liquor, lime is thrown in at a certain stage of the process, so as to combine with the acid factors of the ammoniacal salts, and thus liberate the whole of the ammonia. Ammonia, oil of vitriol, alumina, and water, form,

[1] Six years ago, Dr. Hofmann stated that some promising experiments had been carried out at Alais (Jury report, International Exhibition, 1862, p. 67), but the coke manufacturers do not seem to have yet made any alteration in their plan.

when combined in certain proportions, the alum of commerce. Weak ammoniacal liquids are exhausted of ammonia by heating them to a high temperature in a closed vessel, and suddenly discharging the compressed vapour into water, or weak oil of vitriol.

The utilization of ammonia in the manner here described has thrown into the market an equivalent quantity of potassic salt that was formerly employed for the same purpose. It seems probable that, up to the year 1851, the whole of the alum manufactured in Europe was potassic alum. With the increasing rise in the price of potassic salts, much attention was directed both to cheapening the process of preparation as well as the materials which were required. Now ammonia alum does not differ from the potassic species either in colour, crystalline form, or general applicability. The substitution, therefore, was silently effected; and, to this day, the bulk of the public are ignorant of the very harmless and laudable replacement. Probably the whole of the alum manufactured in England (now more than 300 tons a week) is exclusively the product of the ammonia process.

Were the whole of the ammonia produced annually from coal, in London alone, to be collected in its perfectly pure and dry condition, the yield would amount to approximately three thousand five hundred tons. If all the ammonia now lost in the coke manufacture were to be utilized, instead of being wasted as at present, it could be sold to the consumers at nearly one-half of its present price.

In addition to ammonia and its salts, the aqueous layer contains a small proportion of the analogues of ammonia to which we have already referred. These are known as "the pyridine series," having been thus named after their first member, pyridine, discovered by Anderson. They do not appear to have been a subject of commercial effort, although there is very good reason to believe that they will be made available as sources of colour. They are all highly stable liquids, of somewhat offensive smell. Their presence can be detected in the ammonia of commerce, to which they impart a trace of their odour, and render sufficiently impure to prevent the employment of that product in researches of delicacy.

The Oily Layer.—It is this portion of the tar that possesses so great an interest, whether for the abstract inquirer into chemical laws, the investigator into social causes, or the manufacturer. No better instance, perhaps, could be adduced of a product which has united by one common bond the thoughtful seeker after purely intellectual delights, the pecuniary speculator, and the numberless grades of varying merit that fill the interval between them. Here and there, as we shall see, some guess, or happy conception, or inference, has, in a short time, affected the countless interests of thousands of men. The historical reader will remember how, on a sudden inspiration, the field of Salamanca rewarded an illustrious general; yet I dare not consider the consequences of that brilliant engagement as important as single discoveries made in connection with the black, offensive liquid which we have now to consider.

After the separation of the water (which is promoted by maintaining a moderate heat in the tank), the oily layer is pumped into stills of varying size, but capable, on the average, of containing about a ton each. Heat is cautiously applied, and the distillate condensed by a passage through a worm immersed in cold water. As the operation proceeds, a gradual change takes place in the nature of the product. At first, an oil is obtained which is lighter than water (naphtha, light oil, spirit, &c.); next, an oil which is heavier than water (dead oil); and, lastly, solid products, such as naphthaline, paraffin, anthracene, and chrysene—at which age the worm must be removed. If the distillation has not been pushed to its ultimate stage, the residue in the retort is pitch; but if this condition has been exceeded, only carbon remains in the retort.

Oxygenous Constituents.—The only valuable oxygenous constituent of the oil is phenylic hydrate, or, as it is often termed, "phenol," or "carbolic acid." It is present in considerable quantity in the heavy or dead oil, boiling between 150°—250° C. Instead of obtaining it by the comparatively slow method of rectification, recourse is had to a process depending on what we have termed the alcoholic function of this body.

Phenol, although but sparingly soluble in water, is readily dissolved by an aqueous solution of sodic hydrate (caustic soda), forming a chemical compound therewith. The appropriate fraction of the dead oil is therefore agitated with aqueous sodic hydrate in excess, whereby a watery layer is obtained, which holds all the phenol, while a layer of neutral oil separates it. The sodic phenol solution can therefore be easily drawn off, when it is treated with some acid body (hydric chloride or sulphate) in order to remove the sodium, and set phenol free. The oily phenol is in its turn mechanically removed from the aqueous solution of sodic chloride or sulphate, and subjected to repeated distillation; ultimately it makes its appearance in beautiful white crystals, which melt at about 35° C. Large blocks of it have been several times exhibited.

Phenol has been applied to numerous useful purposes. Its aqueous solution has been used in enormous quantities for washing overcrowded courts and alleys, during the prevalence of epidemics. The same solution injected into the blood-system of animals suffering from the cattle plague, apparently acted efficiently as a remedial agent. Fish die when immersed in it, and their bodies dry up without putrefying; and animal substances of almost every kind are preservable from decomposition by its means. Hence it is invaluable in the dissecting-room, and is much prized as a surgical dressing. Albumen is precipitated by it. The virtues of tar-water, formerly so much extolled, were probably due to its containing a little of this substance.

Pure dry phenol attacks the skin and mucous membranes powerfully; and consequently, if administered internally, is a strong poison. It has a peculiar and very characteristic smell, that can hardly be mistaken. It is utilized on a commercial scale for the production of colours, the stability of which appears to be sufficiently satisfactory. Three of these may be briefly alluded to. Peonine is a product of the joint action of hydric sulphate and oxalate upon phenol; under the influence of heat it is rendered stable by digestion with aqueous ammonia. If peonine be boiled with aniline, a blue colour (phenol blue, azuline) is formed. When phenol is treated with hydric nitrate (nitric acid) a violent reaction occurs, and it is entirely transformed into "picric acid," a yellow dye of considerable beauty and great permanence. Like most of the coal-tar colours, it requires no mordant when applied to silk or wool, but attaches itself at once to the fabric. If, therefore, a white tissue composed of silk and cotton be dipped in a hot solution of picric acid, and afterwards washed, each of its constituents will be readily distinguishable—the cotton by its unaltered appearance, the silk by the yellow hue it has acquired. Picric acid is very crystalline, and but sparingly soluble in water. Its metallic derivatives have of late acquired greater importance. Potassic picrate, for example, has been manufactured for some time past on a considerable scale. Most of our readers will remember the painful catastrophe of the Place de la Sorbonne, in June last, when six persons were killed, others injured, and several houses were much damaged by an explosion of this salt. The trial of the proprietor, M. Fontaine, has but recently occupied the Tribunal Correctionel. A singular fact transpired in the course of the evidence. M. Houzeau had noticed, on the day of the explosion, that the quantity of ozone in the atmosphere of Paris was unusually great. After the accident had occurred, it struck him as not improbable that the detonation might have been due to ozone. Experiment justified his surmise. On placing a few decigrammes of potassic picrate in a flask of ozonized air, a violent explosion took place, and the flask was shattered to pieces.—*Student.*

The Smithsonian Institute has published a descriptive list of the *Smithsonian Publications*, to be had on application to the librarian of the Institute, at Washington.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From February 6th to 13th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Hog Deer (Cervus porcinus) ♂	.....	Born in the Menagerie	Deer-sheds
1 Harnessed Antelope (Tragelaphus scriptus) ♀	Gambia	Received in exchange	Antelope-house
1 Brown Hyæna (Hyæna brunnea)	South Africa	Ditto.....	Carnivora-dens
1 Cape Grass Owl (Scelostrix capensis) *.....	Ditto.....	Ditto.....	At back of Civet Cat's house
1 Cape Eagle Owl (Bubo capensis)*	Ditto.....	Purchased.....	Ditto
1 Lacertine Snake (Cœlopeltis lacertina)*	Africa	Ditto.....	Reptile-house
1 West African Python (Python sebæ)	West Africa.....	Presented by W. C. Small, Esq.....	Ditto
3 White-fronted Guans (Penelope sp.)	South America.....	Purchased.....	Eastern Aviary
2 Mandarin Ducks (Aix galericulata) ♂	China	Ditto.....	Mandarin Pond
1 Lapland Bunting (Centrophanes lapponica)	Europe	Presented by F. Bond, Esq., F.Z.S.	Western Aviary
4 Barred-tailed Pheasants (Phasianus Reevesii) 1 ♂ and 3 ♀	North China.....	Deposited by her Majesty the Queen ...	Pheasantry

♂ Male. ♀ Female. * New to the collection.

FOOD AND DISEASE.

BY PROF. JOHN GAMGEE.

In Two Parts.—Part I.

THE science of life, daily acquiring greater exactitude and completeness, teaches us that as the distribution of food regulates the distribution of animals over the earth's surface, so does the human family branch off in various directions, seeking that abundance denied it when clustered in dense masses over limited areas of country. Human art has sought every means whereby the pre-eminence of old and wealthy centres of civilization might be maintained. But the inexorable laws of nature compel submission—a submission *forced* by famine, under the walls of stately buildings, containing the gold and silver of the wealthiest people in the world, and *illustrated* by the humiliating spectacle of thronged poor-houses and vigorous men seeking transportation to the antipodes, that they may have a chance of "self-help."

Nature has destined that we should be scattered, and whilst the "onward" cry is but the utterance of an instinctive impulse, the observant cannot fail to marvel at the apparently cruel means adopted to enforce Nature's intentions. The religious intolerance and persecution which drove the Pilgrim Fathers to seek a virgin soil exercise but a feeble influence now. The erratic fancies of some, who are born apparently with the strongest animal will and propensities, may colonize and people a wilderness. They snap their fingers at a country's constitution and laws, until steam directs such a current of gentiles into their midst as to secure to humanity all the advantages of a well-organized pioneer's settlement, with ultimate conformity to the regulations most conducive to the result that they shall increase and multiply.

The fear of injury and death operating wherever plagues appear; the Mecca pilgrims sowing the seeds of cholera, which starts forth in many directions, and produces, in a thousand ways, a stampede of which no faithful picture can be imagined but by a few learned in medicine; the malaria which pervades the swamps, or the rich and untilled soils of very fertile lands; the London fog that drives the asthmatic to Australia; these, and a thousand similar influences, constitute apparently the lashes and the tortures which compel old and young, rich and poor, strong and weak, to leave the scenes of their early life, and search for fields fresh and pastures new, where to sow is to reap, and the balance of life can undergo a further adjustment.

The failure of crops, the potato-disease for instance, started an exodus from a thronged island to people the New World.

And now I turn to the least understood of the influences which, affecting the supply of food, tend to scatter and impoverish a nation. The dread of "Carbonchio" has long since rendered desolate during the summer months some of the finest valleys of "the garden of Europe." Flocks of sheep and goats, followed by shepherds and their families, and guarded by fine wolf-dogs with spiked collars, move silently through the towns and villages of Southern Italy in spring and autumn on their way from the lowlands to the Apennines, and *vice versâ*. But for the bells hanging to the rams' necks we should often scarce know that a migration of people was actually going on. Towns are traversed at night or early in the morning, when all is quiet, and those who have sought a mild climate in the south would scarcely believe if told, that pestilential miasms cause the desertion of huts and lands hard by, during at least four months out of every twelve. The steam plough and thorough drainage are destined to exterminate anthrax, whilst they will limit the spread of human consumption; but until the days come when to seek elbow room a man is compelled to remain in a swamp, we may expect the perils of travel to be preferred to the toil and danger of digging and drying the earth in unwholesome regions. The carbonchio of Italy, the bésele of the Pyrenees, the boil-plague of Siberia, are all blood diseases, attacking animals first, and capable of communication to man, which operate in many instances in favour of depopulating certain belts of country, at all events for certain seasons, and developing a taste for adventure which is far from useless in the dissemination of human beings. Creatures of habit, we attach ourselves to places and people so strongly, that any circumstance favouring displacement tends, sooner or later, to form the explorers and travellers who are ever seeking new lands and a new sensation.

It is no stretch whatever of facts or the imagination which enables us to strike an interesting and most instructive contrast between Italy and the British Isles. A hot climate and peculiar formations have given Italy fatal local diseases amongst ruminants, which here assume the mildest types. Italy is a peninsula, and the Alps have not prevented the invasion of Northern Italy, the part most famed for horned cattle, by rinderpest and lung plague to an extent that we knew nothing of prior to 1842. For one outbreak of rinderpest in Great Britain, Italy had in days of yore its dozens; and for one pound of British money lost to our farmers, hundreds were lost in the provinces of Lombardy, Venice, and the Papal States. For generations and centuries the resources of Italy have been sapped by foreign as well as indigenous diseases, so that we cannot wonder if her animals are not the finest in the world and if her agriculture be not ours. I have not chosen Italy for my contrast because it has been in a worse position than other Continental nations; it is a fair type of a large group.

The British Isles, with a genial climate, evergreen pastures, and an ocean barrier, have in a great measure constituted the spot of "natural selection" for improvements in the art and the development of the science of agriculture. Britons pride them-

selves on being more practical and keener observers than other people. In this they are not quite correct; but circumstances, climate, necessity, everything, in fact, that tends to make a man fit for sustained effort, with the incentive for such, may be said to have brought forth here that type of humanity, weighed down in caricature by lumps of fat, but characterized by an iron will and a muscular frame. We have thereby secured a heavy percentage of sound thinkers: *Mens sana in corpore sano.* It is beyond my purpose to trace all the influences which have often diverted us from a just appreciation of the learning, acuteness, and thoroughness of foreigners. Diversity of tongues has done not a little for us in relation to matters coming within the scope of this article.

Whilst schools were being established in various parts of the Continent, to teach a body of men who might make it their business to protect mankind from the irreparable losses incidental to cattle diseases, we slumbered. A Frenchman gave us a start. Vial came from St. Bel, near Lyons, seeking protection from the animosity inspired by his turbulent spirit, or his talents, in the breast of Bourgelat, the founder of veterinary schools, and started one on a sound basis in London. He soon died, and but for Parliamentary aid, the College he established in St. Pancras would soon have ceased to be. I shall not enter on the blunders committed, or the effectual means adopted since to check scientific research and scientific enthusiasm. What I must indicate prominently is, that whereas preventive medicine received a great impulse by the labours of Coleman in relation to ventilation, the subjects of primary importance to an agricultural community, and a knowledge of which would have enlightened political economists in the days of free-trade agitation, were ignored. Our veterinary literature failed to keep pace with the veterinary science of the Continent. We had our pioneers—men who deserved some of the crumbs which contributed to Coleman's great fortune; none deserved so much as Delabere Blaine and William Youatt. The latter wrote on cattle and their diseases, established the *Veterinarian*, and secured the establishment of a Professorship of Cattle Pathology. But even his efforts failed to open the book of Nature sufficiently for the guidance of Sir Robert Peel and his supporters. The veterinary profession under Coleman had contributed largely to the development of an opinion pervading all medical circles, that "fresh air" was the universal panacea. Dirt, confinement, and ill-usage were charged as the causes of all the sickness amongst domestic quadrupeds, and twenty or thirty years since, the proposals first made in 1714 by Bates, Surgeon to the King's Household, for the prevention of cattle plague, were regarded as relics of the dark ages, miserable products of ignorance and superstition. They are of great historical importance in these days, when human physicians have acquired a taste and talent for "stamping out" contagious fevers. Mr. Bates suggested the following regulations:—

"1. That all cows affected with disease should be burned. That all catching the malady afterwards should be burned.

"2. The stables in which the sick cows stood were to be washed and disinfected by burning pitch, tar, and wormwood.

"3. The fields on which sick cattle had grazed were to remain empty for two months.

"4. Persons attending on sick cattle were not to go near healthy ones.

"5. Cowkeepers were to be instructed to separate any cows refusing food, and the cases were to be reported to the authorities.

"6. Cowkeepers were to separate their stock into small lots, each of which was to consist of not more than twelve animals. All complying with the orders were to receive compensation."

Mr. Bates spoke words of wisdom in relation to the prevention of a disease known to be contagious. The complete extinction of rinderpest last century, and our immunity from all "catching" distempers amongst cattle, drove our profession into the belief that they had no great scope for effort except in the daily practice of bleeding and dispensing physic. The organization of veterinary inspectors, or a veterinary department under Government, was looked upon as a foreign element peculiar to paternal Governments. There was no necessity for it. Our forefathers, whose history had been forgotten, blamed the Danes and the Dutch for sending us cattle-diseases; they stamped out the imported plagues, and laid the foundation for an age of great agricultural prosperity, and the formation of superb herds of cattle, by closing our ports to foreign animals and epizootics. Youatt's book gave us a description of British cattle in health, and his chapters on breeds are infinitely better than those on cattle-disease. All this was indirectly due to the efforts of Bates, Cullen, Mortimer, Layard, and others, who rendered our stock-raising possible, and the amount of cattle-destruction a minimum.

The good old days and the good old doctrines formed no part of the study of veterinary surgeons thirty years since. The idea that a Frenchman or a German could teach an English groom or shepherd anything about animals was considered preposterous. Have we not the finest animals in the world? Ergo, must we not be the wisest people on earth in relation to the management of those same animals? The French might write about "Cocotte"; Gerlach might talk learnedly, convincingly, and with effect, in Prussia, as to the contagious nature of the lung disease; and the Russians were engaged in attempts to exterminate rinderpest; but we ignored all, and knew nothing even of the names of these diseases. Youatt confounds all the plagues under one head, and speaks of pleuro-pneumonia as a strange form of pleurisy mentioned by Lecoq. Our aristocracy travelled at great cost; but the daily intercourse which enlightens us now on Continental events was then unknown. How could Sir Robert Peel, Mr. Gladstone, and others, foresee that throwing open British ports for foreign supplies of animal food was the best and safest means to curtail supplies, and strike a blow at our resources, which several decades would fail to repair?

It was, indeed, prior to free trade in live-stock, that experiments were made in crossing some of the breeds of these islands with those of Holland, reputed excellent for dairy purposes. The foot-and-mouth disease and pleuro-pneumonia prevailed extensively abroad; and, since the first of these is transmissible with great readiness, and by all warm-blooded animals, it is not surprising that the earliest importations, small but practical experiments in free trade in live animals, before receiving the sanction of Parliament, led to accidents such as our farmers have had to bear ever since.—*The Food Journal.*

THE PHYSIOLOGY OF THE IRIS.

THE question in what mode the two motor nerves of the iris—the oculo-motor and the sympathetic—act in effecting changes in the diameter of the pupil has recently been the subject of much careful investigation. Histologists, physiologists, and ophthalmologists have alike been interested in its solution; and conclusions differing considerably from each other have resulted from the subject having been examined in different modes and regarded from various points of view. There can be no doubt of the existence of a muscle in the substance of the iris, composed of circularly-arranged fibres, usually of the unstriated variety, surrounding the pupil concentrically. By most authors, as Kölliker, Henle, Brücke, and others, the presence of a second set is admitted, occupying a place somewhat posterior to the former, and arranged in a radiating manner near the periphery of the iris. This also, in man and many other animals, consists of unstriated muscle; but in birds both sets are striated, and subject in their action to the will of the animal. A discrepancy of opinion, however, exists respecting the latter set:

Grünhagen, an able microscopist, denying, on microscopic and microchemical grounds, that any such radiating fibres can be demonstrated in man, mammals generally, or in frogs, and maintaining that the fibres described by Henle are artificial products; he admits a sphincter, but not a dilatator of the pupil. In this state of the question a fresh observer appears in the field—M. Engelhardt, who, without pursuing the anatomical mode of investigation into detail, believes that the facts of the case may be ascertained by the method of experiment, the exciting agent being electricity. This method had already been adopted by Bernstein, and Dr. Engelhardt appears to coincide essentially with the facts arrived at by this investigator. Bernstein found that, on applying the poles of an electric battery to the opposite sides of the cornea of an eye recently removed from the body of a rabbit, dilatation of the pupil was immediately observed. By an analogous experiment, in which four electrodes were applied to the surface of the iris, contraction of the sphincter iridis could be effected, the electric stimulus acting of course, in each instance, in the direction of the length of the fibres called into action, and perpendicularly to the opposite set. And these experiments have been repeated and confirmed by Engelhardt, who adds this further proof of the existence of a dilatator pupillæ: If intense myosis be effected by the instillation of Calabar bean into one eye, irritation of the central extremity of the divided sympathetic in the neck produces no effect, for the sympathetic is paralyzed by the bean; but if a current of electricity be passed across the eye, the electrodes being placed on opposite sides of the cornea, immediate dilatation can be induced, the muscular fibres being then directly called into action. A similar proof of the existence of a dilatator was formerly furnished by Hirschmann, after the pupil had been made to contract with nicotine.

We may just add, in passing, that a paper has appeared in the last number of Schultze's *Archives*, by M. Dogiel, in which he states he has demonstrated microscopically the presence of both a dilatator and a sphincter in a considerable number of animals with the greatest certainty. These being admitted, then, the next point is to determine in what way the movements of the iris are influenced by the third nerve and the sympathetic respectively. To determine this it seemed to be of great importance to discover how the iris behaves when both sets of fibres are either directly or indirectly through these nerves stimulated to the utmost extent; and this may be effected either by the application of two oppositely-charged electrodes to the fibres, or by acting on one set of the fibres with one electrode and the nerve supplying the opposite set of fibres with the other electrode, or by stimulating both nerves coincidently. When both sets of fibres were directly stimulated, the pupil retained its average diameter and circular form, or occasionally became elliptical. When one set of muscles was directly stimulated and the other excited through the nerves, no remarkable preponderance of one over the other set was observed; but when both nerves were simultaneously excited the action of the third was decidedly strongest, strong contraction of the pupil resulting, and it was noticed that the action of the stimulus, when applied through the nerves, was in all instances much greater than when applied directly.

In reference to the action of atropine and of Calabar bean, opinions are as much divided as on the musculature of the iris; some thinking that atropine paralyzes the third and Calabar bean paralyzes the sympathetic (Bernstein, Dogiel, Rosenthal); others, that whilst atropine paralyzes the third it also excites the sympathetic (De Ruiten), and that Calabar bean, whilst it paralyzes the sympathetic, excites the third nerve, or may even have no action on the sympathetic, and simply stimulates the third (Von Graefe, Robertson, Grünhagen, Rogow). From Engelhardt's own experiments, in which, after the employment of atropine, electricity was used as a stimulus, he has arrived at the conclusion that atropine does not paralyze the fibres of the sphincter, but diminishes their excitability through its paralyzing agency on the third nerve. The action of Calabar bean from similar experiments he considers to be stimulating on the extremities of the third nerve. He is further disposed to admit the presence of a ganglionic system of nerves imbedded in the substance of the iris, situated between the radiating and concentric fibres, which acts as an inhibitory centre upon the sympathetic.—*Lancet.*

HOW TO STUDY VARIATIONS IN INSECT SPECIES.

BY H. W. BATES, F.Z.S.

THE idea of the value of localities in connection with specimens or species, with some entomologists, I am afraid does not reach very far. They like to know in what countries the different forms are found, and perhaps, as in French collections, show the distribution by writing the specific names in their cabinets on labels coloured according to the part of the world the species inhabit; the primary divisions of the world, as Europe, North and South America, Africa, Australia, perhaps West Indies, and so forth, being considered sufficient. This brings out the leading facts of distribution very well, such as the restriction of many genera and groups of genera to each of the great divisions, and the distinctive facies which all the products from one region possess; but we seldom see it carried further, and it remains a pretty association of geography with natural history, and no more. Results infinitely more suggestive are brought about if the student labels each *specimen* with its locality, instead of recording it on the ticket which bears the specific name placed below all the specimens, and if he is fortunate enough to be able to amass a large suite of specimens, accurately so ticketed, of genera abounding in local varieties and closely-allied species. Indications of the conditions under which varieties, local races, and perhaps species, are formed in Nature are revealed by this method, and a field of investigation is opened which connects the study of a few insect species with some of the most difficult problems that are now engaging the attention of philosophers. The most common event that happens when a student works at a series of species in this way is the discovery that even the most constant species vary in some parts of their area of distribution; the next, that a small, well-marked difference in a species is generally a local difference, and embraces all the individuals of the district in which it occurs. As the collection increases, further curious facts come out. It is found, for instance, that some highly-variable species give rise to one set of varieties in one area, another distinctly different set in another area, and so on; and further, that in some areas one, or perhaps more, of these variations will be better marked than, and preponderate in number over, the other varieties of the same species. Still further, it is found that in some districts one such variety alone occurs, having apparently prevailed over all the others. To be properly impressed, however, with the great truth and reality of these facts, the student should himself have travelled as an entomological collector over an extent of country embraced by many local varieties of variable species; otherwise his attention will not be sufficiently excited to the curious facts Nature presents to him, and he will not take the trouble to amass and obtain the exact localities of numerous specimens of common variable species. Perhaps the most important result of this attention to distribution of varieties is that a fine gradation of forms or degrees of variation will be found, from the "sport" or variety, such as is liable to be produced in the same brood, to the well-segregated race living in company with another race referrible to the same stock. As such most authors, perhaps rightly, consider these latter as good and true species; and thus the formation of species out of mere variations is illustrated by the facts of geographical distribution.—*From an Address to the Entomological Society of London.*

HOW TO MAKE METEOROLOGY MORE USEFUL IN HORTICULTURE.

IN applying the data afforded by meteorological observations to physiological or cultural purposes, there is this great difficulty, that we have to deal with living organisms. No one can say what life is. Some of the phenomena we now call vital may possibly be no more than peculiar phases or special combinations of physical forces—that is a question for physicists to decide. But, whether or no, every physiologist and every cultivator knows that the indications of the barometer or of the thermometer, or the condition of the hygrometer, are not sufficient of themselves to account for the phenomena witnessed in living beings. The "constitution" of a living organism—we write of necessity vaguely—is in some points more sensitive than mercury or spirit, while, on the other hand, changes which greatly affect the mercurial column have little or no perceptible effect on the organism. This is particularly so in the case of atmospheric pressure, the variations of which have apparently but little influence on plants. If this be true, it follows that many of the observations, so carefully made and so accurately recorded, are for cultural purposes of comparatively little value. In the instance of plants we have as it were to treat every case on its own merits. It is not merely external conditions and local circumstances that we have to consider, but the nature of the plant itself, its condition at any given time, and its power of resisting untoward agencies. The plant which will at one time resist a temperature of 32° Fahr., will at another succumb at a considerably higher degree. Of course this depends upon the stage of growth in which the plant is at the time of exposure—upon its consistence, woody or otherwise—the rarity or density of the fluid it contains—and on a variety of other circumstances well known to practical men and to every physiologist, circumstances dependent more on bygone weather fluctuations than on those now witnessed. The inference from all this is this, that it is not only the existing conditions of the atmosphere that ought to be looked to, but also those which have preceded it. This is a point intelligible and simple enough for all to understand, and yet how very often do we see the gardener or agriculturist tacitly ignore it and attribute the whole of the ill effects he witnesses to present changes. A moment's reflection serves to correct the error, but it is easy to see how the very facility of observing the mercury descend and ascend almost before one's eyes, and of witnessing the corresponding changes on vegetation, may and does often lead to this exaltation of the present over the past.

This tendency might, we think, be overcome by adopting measures which in themselves would give intelligent gardeners more interest in the observation and record of meteorological phenomena, by making them see more clearly than they do now the exact bearing of the fluctuations exhibited by the instruments on the plants they have to take care of. Let us explain ourselves more fully. We have been taught by Boussingault, Gasparin, Quetelet, Glaisher, and others, that a plant requires a certain amount of heat to exist at all, so much more to perfect its woody structures, more still to enable it to flower and ripen its seeds. As practical men we know that these deductions are in the main accurate; that they correspond with facts which come daily under notice; that they explain why it is that certain plants can, and others cannot, be profitably cultivated in certain countries; why it is that a crop in one country ripens only in so many weeks, and why in another it requires so many more.

These facts are patent enough to upper class gardeners, and to persons of any education, but they are not brought home to ordinary workmen as they might be, and as we think they ought to be. We would suggest, therefore, that at the daily observation of the maximum thermometer, not only the actual temperature recorded by that instrument at the time of observation should be recorded, but that the sum of the maxima observed since any particular date fixed on should be ascertained and recorded, by the very simple process of adding the maximum degrees observed each day to the sum of those recorded on previous occasions. In this way the gardener would have an opportunity day by day of seeing the amount of sun-heat received by his plants, he would see whether the daily increase were above or below the average, and in the case of plants subjected to artificial temperature, he could regulate his fire-heat accordingly.

We would specially desire to see the aggregate amount of heat, as ascertained by a thermometer fully exposed to the sun, recorded in this way, because in the case of plants growing under the shade, in diffused lights, the conditions of the problem become more complex, and the difficulty of ascertaining precisely what are the effects of temperature and what of light are proportionately increased. On the other hand, when we turn to the minimum thermometer and its records, we are apt to forget that its indications, below a certain point, are simply useless, as far as regards plants. If the activity of a plant be arrested at a certain degree, as we know it is, still more if it cease to live at all below a certain temperature, wherein, for cultural purposes, is the advantage of recording those degrees which are simply inert as far as regards living organisms? A plant can but die—and if it be killed outright, what can it matter to the gardener that the thermometer registered 10° below killing point?—if it only show a tenth of a degree below that point the result would be the same. We need hardly say the killing point varies very considerably in different plants—each plant, in fact, has a zero of its own, which must be determined by practical experience, and which no thermometer of itself would indicate. The necessity of eliminating useless temperatures from records prepared for the use of the cultivator is insisted on by M. Alphonse De Candolle in his very valuable work, *Géographie Botanique*, and it may be illustrated by the fact that certain plants produce their flowers at a time when, according to the meteorological records as ordinarily codstructed, the mean temperature, even in comparatively low latitudes, is at or below freezing point. Alpine plants, for instance, even in January receive the benefit of an amount of heat not estimated by the ordinary records of mean temperature.

Another point of vital importance, of which ordinary meteorological records take little or no notice, is the duration of favourable or unfavourable temperature. We get maximum and minimum and mean temperatures, and mean daily range, but we do not get what it is very important we should have, if it be possible, the time of day when the thermometer records highest or lowest, and the length of time that a high or low temperature prevails. When a plant is at rest it can resist a lower degree than when it is in full activity, and it can often withstand for a short time an intensity of cold which would be fatal were it continued for a longer period. These are truisms, no doubt, but they are all important to the cultivator, and could the phenomena we have mentioned be recorded, this would prove of great value for physiological purposes. We suppose the only method of even approximately determining the points we have mentioned, is by the combination of self-registering and self-recording instruments such as is effected at the chief observatories by placing the instrument between a gas-light and sensitive paper made to travel by clockwork mechanism with a stated regular movement, so that as the temperature increases or decreases, the mercury in the tube cuts off or admits light to fall on the paper. On this paper is thus traced, minute by minute, throughout the twenty-four hours, the height of the mercury. It is clear this ingenious process could hardly be applied to the maximum or minimum thermometer, but at least it would give us a valuable document to compare with the records obtained in the ordinary manner from the exposed thermometer.

So far, then, as the temperature of the air is concerned, we, as cultivators, particularly want to know the aggregate amount

of useful temperature at different heights above the soil in any given time, the exact period at which favourable or unfavourable changes occur, and their duration.—*Gardeners' Chronicle.*

MANUFACTURE OF THE POINTS OF NEEDLES AND PINS BY ELECTRICITY.

BY C. WIDEUMANN.

A RECENT discovery has been made by M. Cadery, telegraph inspector on the Western Swiss railroad, and is now applied with success at Aix la Chapelle (Belgium), whence needles and pins are shipped to all parts of the world.

On passing a metallic wire (brass, copper, iron, or steel), connected with the negative pole of a Bunsen's battery, through the bottom of a glass tube, closed in such a way as to hold an acidulated liquid, and leading the other wire of the positive pole through the superior opening of the glass tube, closed in such a way as to allow the positive wire to plunge into this acidulated liquid, taking care to leave a small interval between the extremities of the wires; the electric current thus established through the acidulated fluid as a conductor, produces the following phenomena.

Very soon the extremity of the positive wire takes a conical point of more or less sharpness, depending on the free distance existing between the two wires plunging into the acidulated liquid.

During this phenomenon, which takes from 5 to 15 minutes, according to the acid used, its strength, the composition of the wire, its degree of thickness, and also the intensity of the electric current, very fine sections of the wire are seen to separate from the wire.

Water, acidulated with sulphuric acid, appears to be more efficacious, especially for iron and steel wires.

Nitric acid is used in preference for brass and copper wires.

The same effect will take place if to the positive pole (superior) an indefinite number of wires are tied together and dipped in the acidulated water, instead of the single wire, care being always taken to keep this positive wire at a little distance from the negative wire.

I have seen a hundred brass wires after having been submitted to this operation, present points as sharp as the best English pins, although the electric current was produced by a very small Bunsen's battery.

It appears to me very desirable that this new method should receive proper encouragement, and everything should be tried to bring it into general use. The operation of making the points of needles and pins in their manufacture is a dangerous and costly one. Medical men in large manufacturing cities have long recognized the dangerous effects produced by the fine metallic dust resulting from it, on the health of the workmen.

The remedies for this evil are very imperfect, little used, and very impracticable; inhaling apparatus communicating with the outside air has been tried, but every danger would be suppressed by the method above described.—*Scientific American.*

THE VOLCANO-FISH.

BY THE REV. W. W. SPICER, M.A.

ARGES is the name given to a genus of fishes belonging to the family of the Siluroids, nearly related to Pimelodes of Lacepède, but separated on account of the structure of the teeth. Of this genus but two species are known—one found in the fresh waters of the Mission of Santa Anna, in Upper Peru, where it lives the ordinary piscine life under the name of Sabalo; the other, known as Pregnadilla, is the subject of the present notice.

In the year 1803, A. von Humboldt was fortunate enough to witness an eruption of Monte Cotopaxi, a well-known peak, in the northern Andes; during which, among other products, a large quantity of fish was ejected. The inquiries immediately instituted, and the investigations of more recent travellers, have brought to light the astounding fact, that from time to time, though at irregular periods, fishes are cast up from the interior of the mountain during volcanic eruptions. This phenomenon is not confined to Cotopaxi; it has been observed also in other centres of volcanic action—to wit, Tungurahua, Sungay, Imbaburu, Cargueirago, &c., all of them in the same range. From the craters of these volcanoes, or from fissures in their sides, it is an ascertained fact that fish are vomited forth at a height of some 16,000 ft. above the level of the sea, and about half that height above the surrounding plains. The animals all belong to a single species, the *Arges Cyclopum*, as it has been well named. Nor is it a mere chance fish or two that finds its way to the outer world through this strange opening. They are ejected in such countless shoals that, on more than one occasion, the fetid exhalations proceeding from their putrid bodies have spread disease and death over the neighbouring regions. Such was the case in 1691, when the volcano of Imbaburu vomited myriads of these fish over the town of Ibara and its environs. On this occasion pestilential fevers desolated the neighbourhood. The same occurred when the summit of the volcano of Cargueirago fell in (June 10, 1698), and millions of Pregnadillas were thrown out of the sides of the mountain, mingled with mud and clay. At a later period, the lands of a certain Marquis de Salvalegoe were completely covered with these fish, the infectious odour from whose decaying bodies poisoned the surrounding country.

As far as the external world is concerned, *Arges Cyclopum* is known to exist in some lakes on the sides of these mountains 8,000 to 10,000 ft. above the sea-level. It is presumable that these lakes communicate with reservoirs in the interior, where the Pregnadillas are generated, and thus find their way through the crater. But this is mere conjecture. Nor, after all, does it help much towards removing the difficulties by which the phenomenon is surrounded. If these supposed lakes do exist in the interior of the mountain, how strange must be their situation, which allows of fish living in them at an ordinary temperature, and yet places these same fish exactly "in the line of fire" when the contents of this huge earth-stomach are discharged by the crater's mouth!

If the internal lakes do not exist, whence come the myriads of fish which are ever and anon ejected?

Not the least curious part of the affair is, that though some of the fish reach *terra firma* in a half-boiled condition, most of them are perfectly raw, and not a few are even alive, in spite of the fiery ordeal through which they have had to pass.—*Science-Gossip.*

The Darien Surveying Expedition.—According to the *Athenæum* the expedition for the survey of the Darien Canal line was to have sailed from New York before the end of January. Besides the officers of the *Nipsic* and the *Guard*, Commander Thomas O. Selfridge, U.S.N., will have for assistants J. A. Sullivan, M. O. Leman, and Messrs. Ogden, Merriman, and Kärchen, officers of the coast survey; as also a geologist, a botanist, a photographer, a draughtsman, and a telegraph-operator furnished with eighty miles of wire. Commander Selfridge is supplied with a large quantity of articles to be distributed as presents amongst the Indians. Two parties of engineers will start from Sassardi, and one from the southern part of Caledonia Bay, to discover if possible the pass which, as Dr. Cullen contends, exists between the mountains. From these points two lines of levels will be established to wherever the depression may be found, and from thence to the Savana at the mouth of the Lara. The U.S. steamer *Nyack*, of the Pacific squadron, will be in Darien Harbour in readiness to receive the parties from Caledonia Harbour. After the survey of the country between Caledonia Harbour and the Gulf of San Miguel shall have been completed, the vessels will proceed to the Gulf of San Blas, to survey the line from thence to the mouth of the Chepo.

CATCHING TURTLES IN ST. VINCENT.

RUFFS IN THE BREEDING SEASON.

REVIEWS OF BOOKS.

Reptiles and Birds: a Popular Account of their various Orders, with a Description of the Habits and Economy of the most interesting. By Louis Figuier. Edited and adapted by Parker Gilmore ("Ubique"). London: Chapman & Hall. 1870.

THIS last production of M. Figuier's in an English dress needs only a brief notice, since it resembles, in its general style and character, his other works on popular Natural History already familiar to English readers.

The best-known members of the two classes of the Vertebrata of which it treats are described in a lively manner, the descriptions being plentifully interspersed with anecdotes, some of which require the proverbial *granum salis* to enable one to swallow them. The zoological definitions, which are of course of an elementary kind, possess a satisfactory degree of accuracy. In the introductory pages M. Figuier refers to Professor Huxley's views as to the affinities of birds and reptiles, and in admitting these specially guards himself from being supposed to see in them any evidence of their common origin. His argument against Darwin's doctrine of the origin of species is the old one, that in spite of cross-breeding and domestication, the pigeon, for example, remains through all its variations still a pigeon, and the dog a dog. To him the cause of the general plan evident in the structure of animals is "unfathomable and inexplicable."

The French text has been admirably rendered into English, and the editor has also performed his task well. The elegant and creditable "get up" of the volume by the publishers, and the general excellence and careful execution of the three hundred and odd woodcuts which illustrate it, combine to make it a handsome object for the table.

The following account and illustration (see p. 171) of the Ruff, and the other illustration, also taken from M. Figuier's *Reptiles and Birds*, will enable our readers to judge of the contents of the volume better than any comments of ours:—

"The Ruff (*Machetes pugnax*, Temminck) commends itself to the attention of the observer by the sudden metamorphosis which seems to revolutionize its entire nature in the early days of May, at the first dawning of that charming month, when all Nature appears to expand and array itself in every kind of splendour, the better to render homage to the Creator. At this season the plumage of the Ruff, which has hitherto been grave and almost sombre, undergoes a most brilliant transformation. It would strike the observer as if the agitation of love had the effect of totally changing its plumage, from one altogether devoid of display, to the most brilliant costume imaginable, for its neck is now wreathed with a glittering collar, which extends by degrees over shoulders and breast. On the top of its head, to the right and left, two graceful plumes come forth, which vastly improve its looks, and contribute in no small degree to the impressiveness of its demeanour. Brilliant hues of yellow, white, and black, arranged in a hundred ever-varying shades, combine to improve their plumage, making them most attractive to look at.

This physical transformation produces a change in the temper of the bird. Puffed up with pride, and elated at his own personal magnificence, our hero suddenly finds himself subject to the most warlike feelings.

"But what is this object which catches his sight? It is another Ruff—a rival. Without hesitation he rushes immediately to meet the stranger, who, nothing loth, charges in return at the top of his speed. With stretched-out beak and crest erect, the two adversaries impetuously close. A furious duel takes place, carried on in the sight of the feebler sex, who pass their opinion on the blows which are given and received, praise or blame them, and, by a cry at judicious movements, reanimate the failing ardour of the gallant combatants. Fiercer blows with the beak follow one another in quick succession, blood soon flows, and the arena is reddened around them, until at last the two weary champions roll over in the dust, and lie side by side completely exhausted. During two or three months these duels are of frequent occurrence, and cannot fail to leave numerous gaps in the ranks of the species.

"In the beginning of August their rich vestments gradually disappear, and the warlike fever as rapidly abates. The Ruff now becomes a common-place bird of peaceful habits, with no other occupation but that of searching for worms and insects on the shores of the ocean. Then is the time when they fall under the sportsman's gun and into the snares of the bird-catcher," &c.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

Are the Bulgarians Grafted on a Turanian Stock?—*From* C. Böhm.

Sir,—If I am permitted to judge from recent experience it appears to me that—

"Jurare in verba magistri"

is so rigorously observed in a certain quarter of the London scientific world, that opinions which differ from the dictum of persons high in life and position are ungraciously viewed there, and denied publicity, a proceeding which might serve the dark designs of the Vatican but which cannot promote the scientific researches of our age—in England.

I appeal, therefore, with some feeling in the matter, to your courtesy and willingness to throw light on mooted questions by the publication of opinions of all shades. Göthe says—

"Verständige Leute kannst du irren sehen
In Dingen nähmlich, die sie nicht verstehen."

"Understanding people you may see erring
In those things, to wit, which they do not understand."

And I beg to protest, in the name of my Bulgarian friends, against a statement which appeared in *Nature* (Jan. 13th), with respect to the affinity of the Bulgarians and Slavonians—properly Slaves.

The eminent position of *Nature*, and the weight which is attached to the names of its contributors and publishers, make it the more imperative that any assertions proceeding from such a quarter which

may appear to be erroneous, or so expressed as to be conducive to error, should not remain unchallenged or be passed unnoticed. The statement of *Nature*, "that the Bulgarians are grafted on a Turanian stock," is contrary to the evidence furnished by the works of all trustworthy historians of ancient and modern date;[1] nay, the statement "that the Bulgarians are grafted on a Turanian stock" is a direct contradiction of passages in the very pamphlet which is the subject of the article in *Nature;* every one who understands German will see, on referring to it[2] that the old Bulgarians were grafted on a stock of Slaves and not on a "Turanian stock," as *Nature* wishes it to appear.

Professor Max Müller has invented the term "Bulgaric" to designate two Finnic dialects (Toheremissian and Mordvinian), and it is most probable that others have been induced by that classification to stamp the Danubian Bulgarians of "Finnic origin."[3] Professor Max Müller has, however, guarded himself against such a deduction, by the remark "The general name given to these tribes, Bulgaric, is not borrowed from Bulgaria on the Danube," but it is to be regretted that the author of the *Lectures on the Science of Language* goes on repeating the legend about the Finnic armies, which is in opposition to his own statement that the oldest document of the fifth branch of the Aryan family is written in the ancient Bulgarian. Without pointing out that, if we are to take his statements as conclusive, we *must believe*, contrary to common sense, that the old Bulgarians, who dictated the peace to the emperors of Byzanth, dispersed the Servians, and conquered the other Slaves,[4] lost, in the zenith of their power, in the space of about 100 years, their language and customs completely, and brought to a state of high perfection the language of the nations they had conquered.[5]

Those who wish to avoid an error of judgment in writing of the Bulgarian language, history, or origin, should make themselves acquainted with Rakowski's *Starina Bulgarska* (Bulgarian Antiquities),[6] wherein Max Müller's *Science of Language* is reduced to its real value.

I have the honour to be, Sir,

Your obedient servant,

27, *Stanley-street, Feb.* 14. C. Böhm.

Underground Temperature.

Sir,—You will remember last winter we had more volcanic eruptions and earthquakes than this. Some geologists think there is a space between the crust of our earth and the mass of minerals in a state of fusion, which is occupied by the gas which causes earthquakes. If this gas goes on increasing until, like a steam-engine, it lifts the safety-valve (volcano), will it not augment the heat of the earth's crust, or the boiler plates? and when an eruption has taken place these plates become cooler? If so, have we here any clue to the difference in my observation last year and this?

On 1st January, difference ..... 5°
5th " " ..... 3°
30th " " ..... 5°

Undergound heat at 2 ft.:—

1870.		1869.	
Jan. 1	39°	Jan. 1	44°
2	40°		
3	41°		
4 to 12	42°	4	44°
		5	45°
		9 to 11	46°
13	41°	13	45°
14 to 19	42°	18	45°
20 and 21	41°	21	44°
22 to 26	39°	22	43°
		23	42°
		24	41°
		25	40°
		26 not noted.	
27 to 31	38°	27 "	
		28 "	
		29	41°
		30	43°

Yours faithfully,

Havant, Feb. 10. C. J. R.

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[1] Gibbon's *Decline and Fall of Roman Empire*, vol. v. p. 543 (1776-81). Rsich's *History of the Slaves*. St. Petersburg.

[2] Dr. A. Petermann's *Mittheilungen*. 1869. Vol. xii. Die Slaven der Turkey.

[3] Chambers's *Encyclopædia*, vol. ii. p. 418.

[4] Gibbon's *Decline and Fall of Roman Empire* (1776-81), vol. v. *Notes on the South Slavonic Countries*, by Mackenzie & Irby (1865).

[5] *Reflections on the Importance of the Slavonic Language* (1844). *The Turks, the Greeks, and the Slavons*, by Mackenzie & Irby (1867).

[6] Bucharest, 1865; in Bulgarian language.

Meteorology of January, 1870.—*From* F. B. Falkner.

General Results.

Highest temperature of air, on the 7th	49·4°
Lowest temperature of air, on the 27th	18·5°
Total range of temperature of air	30·9°
Mean temperature of air	36·7°
Maximum reading of solar thermometer, on 4th and 29th	76·0°
Minimum reading of the exposed "radiating" thermometer, on 26th	9·0°
Highest observed reading of barometer, on 18th and 19th	30·25 in.
Lowest observed reading of barometer, on 8th	28·52 in.
Observed range of the barometer	1·73 in.
Total fall of rain	1·50 in.

The lower wind was generally from S.W. points up to the 17th, after that, N.E. or N. till the 25th; the air was calm on the 26th and 27th, and S.E. winds prevailed from the 27th to the end of the month. The circumstances of atmospheric temperature refer to a stratum of air 4 ft. from the ground. The barometer is 335 ft. above sea level. The solar barometer has its bulb blackened, and *in vacuo*, and is situated about 3½ ft. from the ground. The "radiating" thermometer indicates the lowest temperature to which unsheltered vegetation near the earth's surface is subjected at night.

I am, Sir, your obedient servant,

F. B. Falkner.

Appleby Grammar School, Leicestershire, Feb. 14.

Sewage Committee of the British Association and the Board of Trade.—*From* Richard B. Grantham.

Sir,—An article in your paper states that the Council of the British Association has requested the Metropolitan Board of Works to subscribe towards the cost of the investigation into this matter, but I beg to correct the error, as the Council have not done so, and request you will state so in your next number.

Your obedient servant,

22, *Whitehall-place, S.W., Feb.* 11. Richard B. Grantham.

[We cannot take any blame to ourselves in making the statement in our last week's number referred to in our correspondent's letter, inasmuch as we had for our authority the report of the meeting of the Metropolitan Board of Works in the daily press, as the following extract will show:—"The Metropolitan Board of Works and the Water Supply.—The usual weekly meeting of the board was held at their offices, Spring-gardens, yesterday; Sir J. Thwaites in the chair. The report of the Works and General Purposes Committee was brought up. It contained, amongst other things, a recommendation that the Committee of the British Association be informed, in reply to their letter asking the board to subscribe towards the cost of their proposed investigation of the subject of the utilization of sewage, that the board regret that they have not the power to comply with the request."—*Daily News*, Feb. 11.—Ed. *S. O.*]

The Brocken.—*From* Dr. F. B. White.

Sir,—When in Switzerland a few years ago, I was fortunate enough to see the phenomenon, regarding the occurrence of which on the Himalayas, "J. H." makes inquiry in your last number. It happened thus:—Going up the Esel, the second highest peak of Mons Pilatus, one August evening, when there was a thick bank of mist to the east of the peak, I was surprised and delighted to see my shadow clearly defined on the wall of mist and surrounded by an elliptical iris or coloured halo. At first I could only see *my own* figure, and my companion only *hers*, but after a while we could see *both*—my shadow, however, being more clearly defined to me than my companion's was, and *vice versâ*. Presently our shadows gave place to a reflection of the whole peak, and those who were on it, on the bank of mist. The sun was close to the horizon, being just about to set when the peak was reflected. There was, as far as I remember, no halo round the shadow of the peak, and the halo round our shadows was not so brightly coloured as, for example, the iris on the spray of a waterfall.

I am, &c.,

Perth, Feb. 14. F. Buchanan White, M.D. Edin.

The Suez Canal and the Tyne.—Mr. Daniel Lange informs us, in relation to a comparison drawn by Mr. Alderman Cowen, at Gateshead, between dredging in the Tyne and in the Suez Canal, that 2,500,000 tons were removed from the Canal in one month, while only 4,000,000 tons were removed from the Tyne in a year.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, FEBRUARY 10TH.—The following papers were read:—"On some remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium," by H. C. Sorby, F.R.S.—When a scientific man has been led into an error and afterwards discovers his mistake, I think it a matter of duty that he should take an early opportunity to correct it. I therefore now write the following notice of certain remarkable peculiarities in the spectra of some compounds of the oxides of uranium with zirconia, which led both myself and others[1] to conclude that they were due to a new elementary substance.

Though the spectra of the different salts of those bases which show well-marked absoption-bands often differ in detail, yet they usually resemble each other so much that there is no difficulty in recognizing each particular element. This is so constantly the case in the various compounds of erbium, didymium, and cobalt, and in the ordinary salts of uranium, that for a long time the more I studied this question, the more did it appear to be a general rule, and there seemed to be no reason to suspect that a few special compounds of uranium would give spectra with absorption-bands as unlike as possible those of all others. Such, however, turns out to be the fact, when its oxides are combined with zirconia.

As an excellent illustration of important differences in mere detail, but general correspondence, I would refer to the spectra of didymium in different states of combination,[2] and would especially refer to the most distinct of the various absorption-bands which occurs in the yellow. The various compounds agree in showing this band in the same general position; but by careful management, and by the use of sufficient dispersive power, it may be resolved into a very variable number of narrow bands or black lines. For example, in the case of the crystallized sulphate containing comparatively little lanthanum, it can be resolved into seven narrow lines, two of those near the centre being the darkest, whereas when much lanthanum is present, one line on the side next the green is so much darker than the rest, that the others are comparatively absent. On fusing the mixed oxides with borax, the same spectrum is seen as with oxide of didymium alone, and I can resolve the above-named band into only two narrower bands, whereas when the saturated bead is made to deposit crystals by being kept some time at a very dull red heat, this band cah easily be resolved into eight equal and very distinct black lines. Although these and similar differences in detail are of much interest, yet in no case are they so considerable as to prevent our recognizing at once that the spectra are all due to didymium. It is also important to notice that the amount requisite to give a most splendid spectrum when the bead is crystalline, will scarcely show any trace of bands when in a vitreous condition, dissolved in the borax. This is analogous to what occurs in the case of solid and powdered crystals of sulphate of didymium; for the absorption-bands in the spectrum of the light transmitted by a thin layer of the fine powder, strongly illuminated from the other side, are as distinct as in that transmitted by a many times greater thickness of solid and transparent crystal. We may very conveniently take advantage of this fact in studying the spectra of such substances, when the amount of material at command is otherwise too small. This seems to be because the transmitted light does not simply pass through the crystals, but is in great measure reflected from them backwards and forwards, and thus, as it were, passes through a greater thickness. It is also to a considerable extent similar to that reflected from the powder when illuminated from above, as may be clearly proved by what occurs in the case of uranic salts. These when in a state of moderately fine powder transmit light, giving a spectrum showing not only the absorption-bands in the blue, which alone are met with in that transmitted by a clear crystal, but also those in the green, which depend on fluorescence, characteristic of that reflected from the powder.[3] These two kinds of bands can be easily distinguished by means of a plate of deep blue cobalt glass, which has an entirely different action, according as it is placed below or above the object when the bands are due to fluorescence, but has no such effect when they are due to ordinary absorption. It would, perhaps, be well to mention here that I have in this manner proved that the abnormal bands seen in the spectra of the compounds of zirconia with the oxides of uranium described in this paper are due to genuine absorption, and not to fluorescence.

The remarkable spectrum of some jargons has been already described by me in the *Chemical News*[4] and in the *Proceedings of the Royal Society*.[5] One of its most striking peculiarities is that when light passes in a direction perpendicular to the principal axis of the crystal, and the spectrum is divided by means of a double-image prism into two spectra, having the light polarized in opposite planes, though some of the absorption-bands are of equal intensity in both images, yet others are comparatively absent, some in one and some in the other; whereas in the case of other dichroic crystals which give spectra with absorption-bands, they are usually all more distinct in one image than when the light is not polarized, and all fainter, or even comparatively absent, in the other. No sooner had I observed this spectrum than I made various experiments in order to ascertain whether uranium was present or not, and the then known tests that could be applied to the amount of material at my command seemed to show that it was absent. This was quite in accord with the results of the various analyses published by other chemists, none of whom mention the existence of any trace of that substance. Moreover the general character of the spectrum was entirely unlike that of all the known compounds of uranic oxide. The various artificial salts all agree in giving a variable, but small, number of moderately broad absorption-bands in the blue end; and the same is also seen in the case of several natural minerals, whereas the jargon gave a most unusually large number of narrow black lines (fourteen quite distinct, besides others more faint, and a single broader band which I cannot separate into lines) extending from the red end, so that nearly all occur in that part of the spectrum which is entirely free from bands in all previously known compounds of uranic oxide; and this same general fact was also seen in the spectrum of the opaque blowpipe-beads gently flamed, as described in my former paper.

I will not now enter into a description of the various chemical and physical facts which seemed to warrant the conclusion that zircons sometimes contain a new earth; but taking these into consideration, there seemed to be every reason to believe that spectra which thus differed so much from those of any previously known substance were characteristic of this new earth. Judging from the facts then known, it was more probable that spectra of such a new type were due to a new element, than that they were due merely to a combination of two such elements as zirconium and uranium. Some of these chemical and physical facts can now be explained by the presence of uranium; but besides this and several of the more common earths and oxides, I have detected in some zircons erbium, didymium, yttria, and another substance which exists in such small quantity that I have not yet been able to ascertain whether or no it is the suspected new earth. These accidental constituents do not indeed occur in sufficient quantity to be of importance, except as modifying the physical and optical properties, the didymium giving the usual characteristic absorption-bands (zircons from Sveneroe, Norway), and the manganese the same spectrum as that of garnets (zircons from an unknown locality in Siberia[6]). This method, however, fails to give evidence of a new earth; for since the publication of my former paper, I have proved that the very abnormal spectra, which seemed sufficient to establish its existence, are really due to compounds of zirconia with the oxides of uranium, which have such a powerful action on light, that an almost inappreciable amount is sufficient to produce the spectra to great perfection—in fact so small an amount, that the total quantity which misled me was only a few thousandths of a grain; and its presence might easily have remained unsuspected, if I had not made a number of experiments, which at first did not seem to have much connection with the subject.

In studying the spectra of crystalline blowpipe-beads, it seemed desirable to examine those made with carbonate of soda, with or without a little borax. This when melted dissolves certain oxides; and though it crystallizes on cooling, so as to be only partially translucent, yet with strong direct sunlight well-marked spectra may be seen. For example, in the oxidizing flame uranic oxide is easily dissolved by carbonate of soda alone, and when quickly cooled, an orange coloured bead is obtained, probably containing uranate of soda in a vitreous condition, which gives a single well-marked absorption-band in the green with so small a quantity of the oxide, that in a bead $\frac{1}{4}$ in. in diameter $\frac{1}{2000}$ grain shows the spectrum to the best advantage, and even $\frac{1}{10000}$ grain can be easily detected. We need not be surprised that this spectrum differs so much from the usual type of uranic salts, since in this case the oxide plays the part of an acid. It may be only an accidental coincidence, but this change is analogous to what so commonly occurs on adding an alkali to neutral solutions of vegetable colours.[7] When gently reheated it seems as if the uranate passed into a crystalline state, for the spectrum then shows four absorption-bands, and is more like the ordinary type; but this change does not occur if a little borax has been added. The addition of more and more borax causes the absorption-band to become more and more faint, and to advance towards the blue end, until we obtain a spectrum with very faint bands but of the usual character.

In examining the various products into which I separated jargons in order to study the supposed new earth in a state of purity, I obtained a small quantity of a dark-coloured substance, apparently zirconia,

[1] See Professor Church's paper, *Chemical News*, vol. xix. p. 121.
[2] See also Bunsen's paper, *Pogg. Ann.*, vol. cxxviii. p. 100.
[3] See Stokes's paper, *Phil. Trans.*, 1852, p. 463, and 1853, p. 392.
[4] Vol. xix. p. 122. [5] Vol. xvii. p. 511.
[6] For both of these I am indebted to my kind friend Mr. David Forbes.
[7] See my paper in *Proc. Roy. Soc.*, 1867, vol. xv. p. 433.

containing some oxide which communicated a green tint to a glassy, borax blowpipe-bead, but yet not sufficiently distinct to show that it was due to uranous oxide. I therefore thought that the carbonate-of-soda method, might throw light on the question; and though the presence of zirconia prevented solution by pure carbonate of soda, the addition of a little borax enables me to prove that uranic oxide is really present in some jargons. Such, then, being the case, it seemed desirable to ascertain whether the oxides of uranium would give rise to any special spectra when present along with zirconia in crystalline blowpipe-beads. To my astonishment I found that the spectra were precisely the same as those obtained in the case of what I had thought to be an approximately pure new earth. When, however, I had ascertained the quantity of oxide requisite to give this result, I was no longer surprised that I had not suspected its presence. In the case of transparent blowpipe-beads of borax with microcosmic salt, it is requisite to have as much as about $\frac{1}{10}$ grain of uranous oxide to show faintly the characteristic absorption-bands, whereas, when present along with zirconia in the crystalline beads, $\frac{1}{2000}$ grain gives an equally well-marked spectrum; and $\frac{1}{2000}$ grain shows it far better than a large quantity, which makes the beads too opaque. These very minute quantities were obtained by the repeated division of a small known weight, either before or after fusion with borax. This spectrum also differs very considerably from the spectra of the usual salts or blowpipe-beads of uranous oxide. On comparing them side by side, the only common peculiarity is the fact of there being numerous absorption-bands distributed over a large part of the spectrum, but they do not correspond in either number or position. On the contrary, they differ almost as much as possible, and the darker bands in the spectrum of this zirconia compound occur where the transmitted light is the brightest in other cases.

The oxide of uranium is so easily reduced at a high temperature to the state of protoxide in a borax-bead, with excess of boric acid, and is so readily peroxidized at a dull-red heat, when crystallized along with borate of zirconia, that there seemed good reason to refer the change in the spectra to temperature rather than to the state of oxidization, until after it was found that they were due to uranium. By gently flaming the crystalline bead, the spectrum is entirely altered, and becomes like that, which seems to be characteristic of a compound of borate of zirconia with uranic oxide. This gives a spectrum with five well-marked absorption-bands, all of which occur at the red end, where no trace of bands exists in the case of ordinary salts. I have tried many experiments in order to ascertain whether any other element besides zirconia will cause uranium to give similar abnormal spectra, but none show anything of the kind—at all events in similar conditions. A few have special characters, as described below, but the majority exert little or no influence; and even when the blowpipe-beads are crystalline, they show only the usual spectra of the oxides of uranium. Moreover no such great change in the character of the spectra of any other elements which give absorption-bands is to be seen when they are combined with zirconia; and, as far as my present experience goes, it seems as if such very abnormal spectra were met with only in the case of these remarkable compounds of zirconia with the oxides of uranium.

Such, then, being the facts, it appears to me that we are now in a position to explain why certain zircons give three different spectra, as described in my former paper. Some jargons (usually those of a green tint) contain a little uranium, so combined that the characteristic spectrum is only faintly visible; whereas, after ignition, the intensity of the absorption bands is permanently increased to a variable extent, occasionally only a little, but in some cases as much as twenty-five times. This more powerful action on light is accompanied by an increase in hardness and in specific gravity—sometimes as much as from 4·20 to 4·60—as described in my former paper; and I have since found that these changes are approximately proportional to the amount of uranic oxide in the various specimens, as shown by comparing the spectra of the blowpipe-beads. This change may partly depend on the oxidization of the uranous oxide, since some specimens slightly increase in weight when ignited; but I think it cannot be mainly due to that; for sometimes there is no such increase, and uranous oxide combined with zirconia gives rise, not to a spectrum without bands, but to one with several of very marked character, as described below. On the whole, since this abnormal type of spectrum is so characteristic of combination with zirconia, it appears to me more probable that the effect of a high temperature is to cause the uranic oxide to combine more specially with the zirconia, as though the greater part existed naturally as a silicate, but after ignition as a zirconiate. We may also apply the same explanation in the case of zircons more or less strongly coloured by other oxides, which become almost colourless when heated, and thus this unexplained peculiarity of zircons may depend on the fact of zirconia being able to play the part of both a base and an acid, which, as compared with silica, has an affinity for bases varying according to the temperature.

The brown-red zircon from Ceylon, named in my former paper, kindly presented to me by Mr. E. L. Mitford, of Rusthall, gives a spectrum precisely like that of the borax blowpipe-beads crystallized after treatment in the deoxidizing flame, and therefore no doubt contains uranous oxide. This spectrum being given by only one part of the crystal, probably depended upon the presence of some substance which either reduced the uranic oxide, or prevented the uranous from oxidization.

These facts thus clearly show that the various spectra which seemed to indicate the presence of a new element existing in three different physical conditions, are in reality only characteristic of the two oxides of uranium combined with zirconia, or not in combination. Perhaps some may think that my having been thus led astray shows that little or no reliance can be placed on the method of investigation employed; but I contend that the mistake was due to its being such an unexpectedly delicate test for uranium, and, as explained above, the error was ultimately corrected by a further development of the same method. As far as the interests of science are concerned, there is no need to regret the general result. We have lost what appeared to be good evidence of a new earth, but have gained an almost entirely new system of blowpipe testing, which enables us to detect such a minute quantity of some substances as could not be recognized by the ordinary means. I shall not now attempt to give anything like a full account of this subject, since it would be much better to let it form part of a paper on various improvements in blowpipe chemistry, but will merely mention a few facts which have a special bearing on the question before us.

In the first place, I would say that zirconia and the oxides of uranium are most useful reagents in detecting the presence of certain substances with which they unite to form compounds having very special characters. The most striking of these are the compounds already described, which are distiguished by the spectra, and not by any well-marked colour—the compound of uric oxide with uranic oxide, which is of a splendid deep blue colour, but shows no absorption-bands; and that of yttria with uranic oxide, which is characterized by a deep orange-colour and extreme fusibility. Thorina and oxide of lanthanum form with uranous oxide compounds which give spectra with absorption-bands in special positions, but of the usual type, and not of such a marked character as to be useful in detecting minute quantities of those substances in mixtures.

In order to see the spectra of the zirconium-uranium compounds, it is requisite that they should be combined and in a crystalline condition. When both constituents are melted in borax and are held in solution, or if when crystals are deposited any other substance replaces either the zirconia or the oxides of uranium, the characteristic spectra cannot be seen. The most simple application of this test for uranium is in the case of various zircons. As much of the powdered mineral as will dissolve should be melted with borax in a circular loop of platinum wire about $\frac{1}{4}$ inch in diameter, so as to give a bead of moderate thickness. A little boric acid should then be added, which not only tends to keep the uranium in the state of protoxide, but also facilitates the crystallization of the borate of zirconia, which is far less soluble when there is excess of boric acid. The bead should then be kept at a bright red heat, just within the deoxidizing flame, until so much borax has been volatilized that small needle-shaped crystals begin to be deposited, when it must be allowed to cool rapidly. It should then be transparent with scattered crystals, and the uranium all in the state of protoxide. On gently reheating it, the bead ought to suddenly turn white and almost opaque; and care must be taken not to heat it any more than is just requisite to cause the borate to crystallize out, or else the uranium will rapidly pass into the state of peroxide. Such beads must be examined by strong direct light from the sun, or from a lamp of very great brilliancy, condensed on them by means of an almost hemispherical lens of about $\frac{1}{4}$-inch focal length; and in addition to the means described in my former paper, I have since found it very convenient to place them over a hole in a black card, so as to entirely prevent the passage of any light which has not penetrated through them, even when so arranged in the focus of the microscope that the spectrum of their thin edges may be examined, if the centre be too thick and opaque. If thus properly prepared, the presence of more or less uranium will be shown by the greater or less intensity of the absorption-bands of the spectrum described and shown in my former paper. This test is so delicate that there is no difficulty in seeing the darker band in the green in the case of zircons which contain no more than $\frac{1}{10}$ per cent. of uranic oxide; and I find that very few localities yield this mineral so free from it that it cannot be easily detected. Those from Miask, Siberia, are the only specimens in which I have not been able to recognize it. The jargons from Ceylon contain an amount varying up to about 1 per cent., although in no published analysis that I have seen is there any allusion to the presence of even a trace. It has also been overlooked in several other cases; and it now becomes important, because it gives rise to various well-defined spectra, which are so characteristic of the different minerals, that they can be very conveniently identified, even when cut and mounted as jewels, by means of the number and position of the absorption-bands.

On flaming the bead at a moderate red heat, the protoxide passes into the peroxide, and the spectrum, characteristic of a compound of borate of zirconia with uranic oxide, may be seen, if sufficient oxide

be present, but considerably more is required than in the case of the protoxide. I may here say that the examination of better preparations has enabled me to detect another distinct band in the extreme red, not described in my former paper, and also an additional faint band in the blue.

In applying this test to detect minute quantities of uranium in other minerals, it is requisite to bear in mind that zirconia may play the part of both an acid and a base, and that various oxides and acids so combine with the zirconia or the oxides of uranium as to prevent the formation of the compounds which give rise to the characteristic spectra. The zirconia appears to combine with some in preference with the uranous oxide, and with others in preference with the uranic, so that, if one spectrum cannot be obtained, the other may; and there are few, if any, cases when neither can be seen, especially if care be taken to use excess of zirconia. If, however, the amount of uranium be very small, and so much of other oxides be present as to make the bead very dark, or too opaque from deposited crystals, before it is sufficiently concentrated for the compounds with the oxides of uranium to crystallize out, it may be impossible to detect it. In order to apply the test in the case of complex minerals, a bead of borax, boric acid, and pure zirconia, should be prepared, then a small quantity of the mineral added, and, after fusion and sufficient concentration, the bead made to crystallize in the manner already described. If needle-shaped crystals be not deposited in the bead when very hot, and if it do not suddenly turn opaque when reheated, the result may not be satisfactory. In this manner it is easy to detect uranium in $\frac{1}{500}$ grain of such minerals as Fergusonite, tyrite, and yttrotantalite, even when they contain no more than 1 or 2 per cent. If in such cases the spectrum of the uranous compound cannot be obtained, the bead should always be flamed and re-examined, to see if that of the uranic compound is thereby developed.

In a similar manner we may make use of a little oxide of uranium to detect zirconia; but the test is far less delicate than the converse, because it is almost impossible to obtain the compound in a crystalline state, unless there be an excess of zirconia. Not more than $\frac{1}{1000}$ grain of uranic oxide should be employed, or the bead may be too opaque. There is no difficulty in thus detecting zirconia in zircons, or in katapleiit; but the presence of so much of other bases in minerals like eudialyte prevents our obtaining a satisfactory result. There certainly could not be a more characteristic test to confirm the results of other methods, or to identify such a small quantity of approximately pure zirconia as could not easily be distinguished in any other way.

The only other compound of uranic oxide of very abnormal character which I have so far discovered, is that with uric oxide. So much of both should be fused with borax in the oxidizing flame as will yield a bead which is perfectly clear, and of pale yellow colour when rapidly cooled, but crystallizes when gently reheated. If the constituents be present in a certain proportion, it then turns from pale yellow to a deep blue, as though coloured by oxide of cobalt. In most cases the bead is rendered nearly opaque by the number of crystals; but sometimes, though it turns deep blue, it remains transparent, owing to the compound being set free in a state similar to that of the red oxide of copper in a borax blow-pipe bead, with carbonate of soda and oxide of tin, treated in the reducing flame. The spectrum of these blue beads shows no absorption-bands, but merely a general absorption at the red end; and it is curious to find that the combination of two yellow substances gives rise to a deep blue, in much the same manner as when the yellow ferrocyanide of potassium is added to a yellow ferric salt. The production of this blue colour on the addition of a little uranic oxide might be employed with advantage to identify moderately small quantities of uric oxide, even when mixed with a number of other substances; but unfortunately the presence of much oxide of lanthanum, which is so commonly associated with it, interferes as though the uric oxide had a stronger affinity for the oxide of lanthanum than for uranic oxide.

The most characteristic peculiarity of the compound of yttria and uranic oxide is that it will not crystallize out from a borax blowpipe-bead, and that the affinity of the uranic oxide for yttria is stronger than for zirconia. Perhaps erbia may prove to act in the same way, but I have not been able to examine that earth quite free from yttria. On adding yttria to a bead with zirconia and a little uranic oxide, and gently flaming it in the oxidizing flame, the uranic oxide combines with the yttria and rises to the surface as an orange-coloured scum, which has a great tendency to collect on the platinum wire; and if sufficient yttria was added, the crystallized borate of zirconia is left in the interior almost colourless, and so free from uranic oxide that no absorption-bands can be seen in the spectrum. We may take advantage of this circumstance to detect yttria in small quantities of compound minerals like Gadolinite and Fergusonite; and I may here say that by combining such means with the observation of the spectra of the transparent or crystalline beads, and of the form of the crystals when slowly deposited, with or without the addition of suitable reagents,[8] we may often detect twice as many constituents in minerals as could be accomplished by the ordinary methods of blowpipe chemistry—an advantage which I am sure will be appreciated by those engaged in the study of rocks, when it is often so important to obtain satisfactory results with small quantities of material. I have also found these methods of great practical use in examining small residues in the qualitative analysis of minerals, and have thus unexpectedly discovered small quantities of comparatively rare elements.

I have tried the effect of many other substances along with zirconia and the oxides of uranium, and find that most of them have no sensible influence, unless they are present in considerable relative quantity. The most striking effect is that of oxide of tin, which causes the two absorption-bands in the yellow and yellow end of the green in the spectrum of the uranous oxide compound to be nearly equally dark, whereas, without the oxide of tin that in the yellow is comparatively faint. This is another illustration of the manner in which certain substances, having no special action on light, influence by their presence the properties of another. The oxides of uranium are unusually sensitive to such actions, and thus not only lend themselves to us as blowpipe-reagents, but also seem more than any others to afford the means of explaining the relation between the physical conditions of compounds and their action on light.

The only compound of zirconia with any other oxide to which I need now draw attention, is that with chromic oxide, as deposited from a borax blowpipe-bead. When treated in the deoxidizing-flame, and when cold, the very pale-green bead gently reheated, this compound crystallizes out so as to give a fine red-pink colour by transmitted light, even when so little chromium is present that the glassy bead is scarcely at all green. If too strongly heated the pink tint is lost. This compound is of interest in connection with the colour of rubies and other minerals coloured red by chromic oxide, which acts on light in such a variable manner according to the presence of other substances, that the spectra may be made use of as a means of identifying particular minerals, though they do not present anything like such striking anomalies as those met in the compounds of zirconia with the oxides of uranium.

"On the Mathematical Theory of Stream-lines, especially those with four Foci and upwards," by William John Macquorn Rankine, C.E., LL.D., F.R.SS. Lond. and Edin., &c.—A *Stream-line* is the line that is traced by a particle in a current of fluid. In a steady current, each individual stream-line preserves its figure and position unchanged, and marks the track of a filament or continuous series of particles that follow each other. The motions in different parts of a steady current may be represented to the eye and to the mind by means of a group of stream-lines.

Stream-lines are important in connection with naval architecture; for the curves which the particles of water describe relatively to a ship, in moving past her, are stream-lines; and if the figure of a ship is such that the particles of water glide smoothly over her skin, that figure is a *stream-line surface;* being a surface which contains an indefinite number of stream-lines.

The author in a previous paper proposed to call such stream-lines *Neoïds;* that is, ship-shape lines.

The author refers to previous investigations relating to stream-lines, and especially to those of Mr. Stokes, in the Cambridge *Transactions* for 1842 and 1850, on the "Motion of a Liquid past a Solid," and of Dr. Hoppe, on the "Stream-lines generated by a Sphere," in the *Quarterly Journal of Mathematics* for 1856, and to his own previous papers on "Plane Water-lines in Two Dimensions," in the *Philosophical Transactions* for 1864, and on "Stream-lines," in the *Philosophical Magazine* for that year. He states that all the Neoïd, or ship-shape, stream-lines whose properties have hitherto been investigated in detail, are either *unifocal* or *bifocal;* that is to say, they may be conceived to be generated by the combination of a uniform progressive motion, with another motion consisting in a divergence of the particles from a certain point or focus, followed by a convergence either towards the same point or towards a second point. Those which are continuous closed curves, when unifocal, are circular, and when bifocal, are blunt-ended ovals, in which the length may exceed the breadth in any given proportions. To obtain a unifocal or bifocal neoïd resembling a longitudinal line of a ship with sharp ends, it is necessary to take a part only of a stream-line, and then there is discontinuity of form and of motion at each of the two ends of that line.

The author states that the occasion of the investigation described in the present paper was the communication to him by Mr. William Froude of some results of experiments of his on the resistance of model boats, of lengths ranging from 3 ft. to 12 ft. A summary of those results is printed at the end of a Report to the British Association on the state of "Existing Knowledge of the Qualities of Ships." In each case two models were compared together of equal displacement and equal length; the water-line of one was a wave-line with fine sharp ends, that of the other had blunt rounded ends, each joined to the midship body by a slightly hollow neck; a form suggested, Mr. Froude states, by the appearance of water-birds when swimming. At low velocities, the resistance of the sharp-ended boat

[8] See my paper, *Monthly Microscopical Journal*, vol. i. p. 349.

was the smaller; at a certain velocity, bearing a definite relation to the length of the model, the resistances became equal; and at higher velocities, the round-ended model had a rapidly-increasing advantage over the sharp-ended model.

Hence it appeared to the author to be desirable to investigate the mathematical properties of stream-lines resembling the water-lines of Mr. Froude's bird-like models; and he has found that endless varieties of such forms, all closed curves free from discontinuity of form and of motion, may be obtained by using *four* foci instead of two. They may be called from this property *quadrifocal stream-lines*, or, from the idea that suggested such shapes to Mr. Froude, *Cycnoïds*; that is, swan-like lines.[10]

Those lines are not to be confounded with the lines of a yacht having at a distance the appearance of a swan, which was designed and built some years ago by Mr. Peacock, for the figure of that vessel is simply oval.

The paper contains four chapters. The first three are mainly cinematical and geometrical, and relate to the forms of stream-line surfaces in two and in three dimensions, especially those with more than one pair of foci and surfaces of revolution, to the methods of constructing graphically and without calculation, by means of processes first applied to lines of magnetic force by Mr. Clerk Maxwell, the traces of such surfaces, which methods are exemplified by diagrams drawn to scale, and to the motions of the particles of liquid past those surfaces. The fourth chapter is dynamical: it treats of the momentum and of the energy of the disturbance in the liquid, caused by the progressive motion of a solid that is bounded by a ship-shape stream-line surface of any figure whatsoever; of the ratio borne by the total energy of the disturbance in the liquid to that of the disturbing body when that body displaces a mass of liquid equal to its own mass, which ratio ranges in different cases from $\frac{1}{2}$ to 1; of the acceleration and retardation of ships as affected by the disturbance in the water, and especially of the use of experiments on the retardation of ships in finding their resistance; and of the disturbances of pressure which accompany the disturbances of motion in the liquid. Up to this point, the dynamical principles arrived at in the fourth chapter are certain and exact, like the geometrical and cinematic principles in the three preceding chapters. The results obtained in the remainder of the fourth chapter are in some respects approximate and conjectural, and are to a great extent designed to suggest plans for future experiments, and rules for their reduction. These results relate to the disturbances of level which accompany the disturbances of motion, when the liquid has a free upper surface, to the waves which originate in those disturbances of level, and the action of those waves in dispersing energy and so causing resistance to the motion of the vessel; to friction, or skin-resistance, and the "wake" or following current which that kind of resistance causes the disturbing solid body to drag behind it, and to the action of propelling instruments in overcoming different kinds of resistance.

The resistance caused by viscosity is not treated of, because its laws have been completely investigated by Mr. Stokes; and because for bodies of the size of ships, and moving at their ordinary velocities, that kind of resistance is inconsiderable compared with skin-resistance and wave-resistance. The resistance caused by discontinuity of figure is stated to be analogous in its effects to friction, but it is not investigated in detail, because ships ought not to be built of discontinuous (commonly called "unfair") figures.

In a supplement to this paper the author in the first place calls attention to the agreement between the position of the points at which there is no disturbance of the pressure on the surface of a sphere, as deduced from Dr. Hoppe's investigation, published in 1856 (*Quarterly Journal of Mathematics*), and on the surface of a short vertical cylinder with a flat bottom, as determined by the experiments of the Rev. E. L. Berthon before 1850 (*Proc. Roy. Soc.* vol. v. 1850; also, *Transactions of the Society of Engineers*, 6th December, 1869). The theoretical value of the angular distance of those points from the foremost pole of the sphere is $\sin - 1\frac{2}{3} = 41° 49'$; the value deduced from experiment is 41° 30′.

The author then adds some remarks on a suggestion made by Mr. William Froude, that the wave-resistance of a ship is diminished when two series of waves originating at different points of her surface partially neutralize each other by interference; and states that, with regard to this and many other questions of the resistance of vessels, a great advancement of knowledge is to be expected from the publication in detail of the results of experiments on which Mr. Froude has long been engaged.

"On Linear Differential Equations," No. II., by W. H. L. Russell, F.R.S.

[10] Κυκνοειδής.

ZOOLOGICAL SOCIETY OF LONDON.

FEBRUARY 10TH.—John Gould, Esq., F.R.S., V.P., in the chair.—The secretary read some notices on the principal additions to the society's menagerie during the month of January, amongst which was a specimen of the Great Northern Diver (*Colymbus glacialis*), captured in Cornwall, and presented to the society by A. R. Hunt, Esq.

A letter was read from Mr. W. H. Hudson, of Buenos Ayres, containing observations on the ornithology of La Plata.

A communication was read from Mr. R. Swinhoe, C.M.Z.S., containing the description of a new deer from China, which Mr. Swinhoe regarded as constituting a new genus of the family Cervidæ, distinguished by the large canines and the entire want of horns in both sexes. This deer was stated to be common on the islands on the lower part of the river Yangtze-Kiang near Ching-Kiang, and to be often brought into the market of that city, but appeared hitherto to have escaped the observation of naturalists. Mr. Swinhoe proposed to call it *Hydropotes inermis*.

A communication was read from Mr. George Gulliver, F.R.S., on the size of the red corpuscles of the blood of Moschus, Tragulus, Orycteropus, Ailurus, and some other mammalia, to which were added some historical notices relating to the same subject.

A communication was read from Surgeon Francis Day, F.Z.S, containing the second portion of his paper on the "Fishes of Burmah."

The Rev. O. P. Cambridge communicated a monograph of the genus Idiops belonging to the family Mygalides, in which were included descriptions of three species considered to be new to science.

A communication was read from Mr. John Brazier, C.M.Z.S., containing descriptions of three new species of shells from the Australian coast belonging to the genera Voluta and Conus.

Mr. Henry Adams communicated a description of a new species of mollusk of the genus Colus, from L'Agulhas Bank, Cape of Good Hope, which he proposed to call *Colus ventricosus*.

ETHNOLOGICAL SOCIETY.

TUESDAY, FABRUARY 8TH.—Dr. A. Campbell in the chair. The following new members were announced:—Sir Charles Wentworth Dilke, Bart., M.P.; Rev. A. S. Farrar, D.D.; Messrs. M. C. Fisher, F. K. Munton, and F. B. Wright.

Mr. Boyd Dawkins, F.R.S., read a paper on some flakes of flint and chert discovered in the angular detritus beneath a submerged forest at Porlock and Minehead, in West Somerset. These objects of human workmanship prove that man must have lived on the old land-surface before the destruction of the forest and the accumulation of the series of overlying deposit. It has been supposed that this detritus was of Glacial age, but the author is inclined to dispute this. He believes that there is evidence to show that the latest date which can be assigned to these remains is an early stage in the Neolithic period. Dr. Richard King, Colonel Lane Fox, Rev. Dr. Nicholas, and Mr. McLennan spoke upon this communication.

The chairman read some notes introductory to a paper on the remains of prehistoric man in the neighbourhood of the Crinan Canal, in Argyllshire. This was a paper by the Rev. Mr. Mapleton, in which he describes some peculiar cup-shaped cavities and concentric rings, rudely sculptured on certain stones in this locality. In addition to these petroglyphs, there are many menhirs and numerous cairns of various forms. Crannogs occur in most of the lochs, but are usually merely solitary dwellings. Some dunes, a vitrified fort, a brough, and a flint-manufactory are also among the remains of this locality. The Rev. Dr. Nicholas and Colonel Fox made remarks upon this paper. Mr. F. W. Rudler exhibited and described a stone hammer-head found by Mr. R. Mouat in the old workings of a copper-mine in Portugal.

CHEMICAL SOCIETY. [1]

FEBRUARY 3RD.—Dr. A. W. Williamson, F.R.S., &c., president, in the chair. Mr. Chapman read "A Note on the Organic Matter contained in the Air."—Some time ago, the author, in connection with Mr. Wanklyn and Mr. Smith, found that the smallest traces of nitrogenous organic matter in water could be detected by converting the nitrogen of the organic matter into ammonia, and then trying with Nessler's test. It occurred to the experimenters that the process might be extended to the investigation of the air, by washing it with water, and examining the water; but Mr. Chapman found the operation of washing the air more difficult than he had expected. It seemed the most obvious method to draw air through water, or through some other medium which would have afterwards to be washed with water. The absorption by water alone proved insufficient. Filters of cotton-wool and gun-cotton acted very well; but neither of the two materials could be obtained free from traces of nitrogenous substances. Asbestos seemed to be sufficiently good; but the preparatory treatment it has to undergo before its use in the experiment is too troublesome. Lastly, finely-powdered pumice-stone was tried as a filtering medium, and was found satisfactory in all respects. It has to be heated to redness before it is employed, and is then moistened with

[1] We are indebted for the above report to the *Chemical News*.

some water, spread over coarser pieces of pumice, which rest on some wire-gauze fitted into a funnel. When a sufficient quantity of air (say 100 litres) has been drawn through the apparatus the pumice is transferred to a retort which contains water freed from ammonia and organic matters; and the operation is now proceeded with exactly as if it were an estimation of nitrogenous organic matter in a sample of water.

By this method Mr. Chapman found that the air of crowded rooms contains suspended nitrogenous organic matter, as volatile organic bases. The first can be removed by filtration through cotton wool; the latter pass through the filter, and when conducted into water can be detected there. Air collected from the neighbourhood of a sewer contained notable quantities of these volatile bases. The author thinks it would be of interest to investigate, by the above-described method, the air in hospitals, fever-wards, and the like places.

With respect to the examination of the volatile bases occurring in the air, Dr. Mills suggested that the charcoal out of the Stenhouse air-filter might furnish a good means for collecting those bases.

In another paper, Mr. Chapman communicated "Some New Reactions of Alcohols."—Amylic alcohol, as commonly obtained, consists of two liquids, one rotating a ray of polarized light, the other not. The two may be separated by distilling the mixture from soda, calcic chloride, &c. The non-rotating alcohol is retained; the rotation distils over. But, by repeated distillations, it was found that the rotating alcohol is converted into the non-rotating by the very treatment employed to separate the two. No difference in the physical properties of the two alcohols is perceptible. The compounds of the non-rotating liquid do not turn the ray of polarized light; those of the rotating do, and that in an opposite direction to the original alcohol. These facts seem to indicate that the internal structure of organic compounds is not so permanent as we are in the habit of thinking. Another observation Mr. Chapman made whilst pursuing these experiments was that caustic soda is not merely unable to dry alcohol, but that it actually hydrates it. On proper investigation, it turned out that the sodium replaces the hydrogen of the alcohol, whilst the displaced hydrogen takes the place of the sodium in the caustic soda, and thus produces water.

The president, referring to this latter observation, remarked that it confirmed the idea of a double decomposition taking place when potassic hydrate is dissolved in alcohol—an idea derived from the well-known reaction of carbonic acid on a solution of potassic hydrate in alcohol, whereby ethylo-potassic carbonate, as well as potassic carbonate is found.

Mr. Perkin exhibited a modification of Berthelot's method for the synthesis of hydric cyanide by direct union of acetylene and nitrogen under the influence of the electric spark. Mr. Perkin takes advantage of the fact that nearly all the hydrocarbons yield, when submitted in the state of vapour to the action of the spark, more or less acetylene. Nitrogen was caused to bubble through benzole; then to pass through a globe, in which the spark was discharged; and thence into a solution of silver. After a few seconds, abundant evidence of the formation of hydric cyanide was obtained. Hydric cyanide was also produced when the spark was discharged through a mixture of ammonia gas and ether vapour. If, however, nitrogen, instead of ammonia, is employed, no cyanide is produced, notwithstanding that acetylene is formed from the ether. Mr. Perkin's modification of Berthelot's method is well adapted for purposes of lecture-demonstration.

ENTOMOLOGICAL SOCIETY.

February 7th.—Alfred R. Wallace, Esq., F.Z.S., &c., president, in the chair. Mr. Wallace returned thanks for his election to the presidency; and nominated as vice-presidents Mr. Bates, Major Parry, and Mr. Pascoe.

It was announced that the council offered two prizes of the value of five guineas each for essays of sufficient merit and drawn up from personal observation, on the anatomy or economy of any insect or insects. The essays to be sent in before the end of November next.

Mr. Bond and Professor Westwood exhibited several butterflies, the coloration of each of which was partly of the male and partly of the female character. Mr. Bond, on behalf of Dr. Wallace, exhibited cocoons from various parts of the world of *Bombyx Yama-mai* and *Antheræa Pernii*. Mr. Stainton exhibited a large box full of Micro-Lepidoptera, each specimen being separately labelled to show the locality and date of capture. Mr. Bond exhibited some more specimens of *Acridium peregrinum* from Plymouth; and Mr. Frederick Smith made some observations upon the *Locusta migratoria* of Linné and *L. Christii* of Curtis. Professor Westwood exhibited a new form of Cynipidæ, from the Sula Islands. Mr. Janson, on behalf of Mr. Cratch, exhibited *Philonthus cicatricosus*, *Dyschirius angustatus*, *Hydroporus unistriatus*, and *H. minutissimus*, four recent additions to the list of British Beetles. Major Parry exhibited *Nicagus obscurus*, a North American species placed by Leconte among the Scarabæidæ, but which it had since been suggested might possibly belong to the Lucanidæ. The secretary read a letter from Mr. Roland Trimen on the habits of some South African species of Paussidæ.

The following papers were read:—"A Revised Catalogue of the Lucanoid Coleoptera with Remarks on the Nomenclature and Descriptions of New Species," (the concluding part), by Major Parry. "On the species of Charaxes described in the *Reise der Novara*, with Descriptions of two New Species," by Mr. A. G. Butler. Mr. McLachlan presented the MS. of "A Catalogue of the Neuroptera of the British Isles," being the first instalment of the proposed list of all our indigenous insects. Part 6 of the *Transactions* for 1869 completing the volume, was on the table.

GEOLOGISTS' ASSOCIATION.

February 4th.—Prof. J. Morris, F.G.S., president, in the chair. Mr. W. Carruthers, F.L.S., read a paper on the general characters of Graptolites. The author reviewed the bibliography of the subject, and stated that the generic name Graptolithus was first employed by Linnæus, in 1736, for certain natural objects resembling true petrifactions; but the real forms to which the name is now confined were recorded in 1767 in his 12th edition of the *Systema Naturæ*, where, however, of the eight species mentioned one only is a true Graptolite, and this—the *G. scalaris*—belongs now to another genus (*Climacograptus*, Hall); for the *G. saggitarius* of Linnæus was founded on a fragment of a Lepidodendron, and this name was wrongly applied by Hisinger and subsequent writers, and has thus caused the Linnæan generic name to be applied to a species with a single series of cells, whereas the only *true* graptolite, described by Linnæus, had a double series. Nillson applied the name Triodon and Bronn that of Lomatoceros to the same form; but the term at present used (Graptolites) was adopted in the Silurian System, 1839. Barrande divided the genus into two sections,—viz., Monoprion and Diprion, according as the species possessed a *single* or a *double* series of cells; and separated two marked forms—Retiolites and Rastrites. McCoy about the same time, in retaining for the first the original name, proposed Diplograpsus for the second.

Mr. Carruthers, in alluding to their position in nature, pointed out their affinity to the Hydrozoa, and in describing the characters used the terms adopted by Huxley and Allman for that group. The structure of the graptolite is comparatively simple, the trophosome, or portion destined for growth and nutrition, consists of the "cœnosarc" or common basis, uniting the various individuals or polypites, the investing portion being the periderm, and the cup-like receptacle for the polypite, the hydrotheca, and the non-cellulliferous portion is formed by the hydrorhiza or root-like termination, and the hydrocaulis or intervening portion to the hydrorhiza and first hydrotheca. The tube of the polypary strengthened by a slender axis (always present in the true graptolite) gives off hydrothecæ at regular intervals, as Rastrites, or is partly formed of the conjoined bases of uniserial or biserial hydrothecæ; the genera Retiolites and Phyllograptus somewhat differ,—the former has no central axis, but an internal canal, and the latter, with a solid axis, but destitute of a common canal. There are other genera in which cells have not been observed, and Dictyonema, the affinity of which is doubtful.

Of the six orders of oceanic Hydrozoa established by Professor Huxley, the Sertularidæ are the forms to which these curious Silurian fossils are most nearly allied. From the comparison instituted by Mr. Carruthers, as to the composition and parts of the graptolite, but differing from Sertularia in having a solid axis to the polypary; and the general differentiation from the Bryozoa was also pointed out in their having a common canal, as in the Hydrozoa. The genera were succinctly described and the relations to each other mentioned—as Cyrtograpsus to Graptolithus, Dendograpsus to Cladograpsus, and the aberrant forms were also noticed. Messrs. Evans, Hopkinson, and Kent made some observations on the character, affinities, and geological distribution of this family, which appear to have been most numerous during the Lower Silurian period both in Europe and America.

ROYAL BOTANIC SOCIETY.

On Saturday a meeting of this society was held at the gardens, Regent's Park, Lord Alfred Hervey in the chair, when ten new fellows were elected, and the names of the following candidates read:—Mrs. T. H. Bryant, Mrs. J. Draper, Mr. J. Farmer, Mrs. Fleming, Edwin Lawrence, LL.B., Miss Llewellyn, G. E. Payter, H. I. Veitch, Mrs. Burra, and Mrs. Vincent. Copies of the new schedules of prizes offered for competition at the exhibitions of the coming season were distributed. In addition to the usual prizes, this schedule comprises several novelties, such as prizes for the arrangement of greenhouse and bedding plants, for plants and flowers grown and arranged for special decorative purposes, for fern-cases, flower-baskets, &c., and other garden accessories; and a special division, headed by her Royal Highness Princess Mary, with a gold medal, devoted to ladies, for bouquets, table decoratives, window-boxes, &c.

RICHMOND AND NORTH RIDING NATURALISTS' FIELD CLUB.

The usual monthly meeting was held in the museum on Tuesday, the 8th inst., at 8 o'clock p.m., the president, Mr. Wood, F.G.S., in the chair, who exhibited a large and very perfect spine of *Hybodus reticulatus*, Ag., and an equally beautiful *Extracrinus Briareus*, Miller, both from the lias of Lyme Regis; blocks of carboniferous limestone, from near Richmond, containing specimens of fishes' teeth, proving conclusively that the hitherto supposed distinct genera Ctenopetalus and Petalorhynchus are one and the same; a charming specimen of the fishes' palate, Janassa, from the marl slate of Middridge, a present from Mr. Duff, of Etherley, to the Earl of Enniskillen, and a fine example of the same from the coal-shale of Carluke, out of his lordship's collection, illustrating Messrs. Hancock and Howse's important paper in the *Annals* for January; gigantic bones of the Iguanodon, dredged up from the Wealden, at Ventnor, Isle of Wight—the president explained the great interest of this formation, it being the earliest known fresh-water deposit, and the seat of the first iron-smelting in England; a calculus, presented to the club by the Rev. J. W. Wilson, of Kirby Fleetham, of nearly 18 in. in circumference, taken from the stomach of a horse—its great size and weight caused much astonishment, and elicited an interesting explanation of these curious phenomena from the president and Dr. Armstrong.

A Brachiopod *Productus giganteus*, the largest of this important family, from the Yoredale Rocks, at Gilling, and a curious malformation of crab's claw, showing the wonderful power of Nature in repairing accidental damages, were presented by Mr. Leonard Thompson.

A number of very fine goats' skins, from the mountains north of Inverness, combining warmth and beauty in a high degree, were sent for exhibition by Mr. Barr.

YORKSHIRE NATURALISTS' CLUB.

The annual meeting of this club was held on Wednesday, the 9th inst., at Mr. Graham's, Market-street, York; S. W. North, Esq., in the chair. Mr. C. Lawton, of New-street, was elected a member of the club. Mr. C. Wakefield, the secretary, then read the following report for 1869:—In presenting their report for the year 1869, the committee of the Yorkshire Naturalists' Club have to congratulate the members on the continued prosperity and increased activity of the club. The monthly meetings of the club have been regularly held and generally well attended, although there is still room for improvement in the latter particular. Numerous specimens in various departments of natural history have been exhibited, and much valuable information has thereby been elicited, giving sufficient evidence of the zeal and assiduity displayed by some of our Yorkshire naturalists in the cultivation of those departments of science to which their attention is specially devoted. The club has been greatly indebted on more than one occasion to Mr. J. F. Walker, and also to Mr. E. Allen for the trouble they have taken in bringing numerous geological specimens of great interest to the meetings, and explaining the characters of many interesting and rare fossils; to Mr. Graham for the constant supply of objects of interest with which he has supplied the meetings; and to Mr. Hind for the exhibition of numerous specimens of entomology. During the past year the following papers have been read:—In February, "On the Speeton Clay Formation," by Mr. E. Allen, F.G.S; in April, "On the Classification of the Cretaceous Rocks with Reference to the Age of the Cambridge Phosphatic Bed," by Mr. J. F. Walker, F.G.S.; in June, "On the Chalk Formation in general," by Mr. E. Allen; and in November, "On the Red Chalk," by the Rev. J. F. Blake, F.G.S. Six new members were elected into the club during the past year, and the total number of *bonâ-fide* members now amounts to 110.

The following additions have been made to the library:—*The Transactions of the Zoological Society of London*, vol. vi. parts 5 to 7, presented by Basil T. Woodd, Esq.; *Für Darwin*, by Mr. W. S. Dallas, the translator; and Mr. Wanklyn's paper on some new species of fossil ferns from the Bournemouth leaf-bed, by Mr. Walker; by purchase, the *Report of the Royal Geographical Society*, the *Zoologist*, and *Entomologist's Annual* for 1868. In conclusion, your committee cannot but regret that various causes have operated to prevent the club taking excursions into the country, and hope that in the coming season they may be able to arrange several excursions which cannot but be extremely agreeable as well as useful. They will not only tend to make the members better acquainted with one another, but will also probably furnish many matters of interest for our monthly meetings.

The committee recommend the election of the following gentlemen as officers of the club during the present year:—President, the Hon. Payan Dawnay; vice-presidents, the Rev. Canon Hey, M.A., J. Leckenby, Esq., F.G.S., S. W. North, Esq., Rev. G. Rowe, M.A., E. Wood, Esq., F.G.S.; and Basil T. Woodd, Esq.; treasurer, E. Smallwood, Esq.; hon. secretary, Mr. C. Wakefield; committee—E. Allen, Esq., F.G.S., W. C. Anderson, Esq., D. Graham, Esq., T. S. Noble, Esq., F.R.A.S., and W. Procter, Esq., M.D., F.C.S. The committee have also much pleasure in proposing, as honorary member, W. Mudd, Esq., A.L.S., curator of the Botanic Gardens, Cambridge, who has written several books and papers on cryptogamic botany.

The adoption of the report of the committee, and the election of the officers and honorary members, in accordance with the recommendation of the report, was proposed by Mr. W. C. Anderson, seconded by Mr. W. A. Phillips, and carried unanimously.

Mr. Walker proposed, and Mr. Phillips seconded, that the thanks of the club be given to the officers for their valuable services during the past year.

The members then sat down to partake of refreshments, most kindly provided for them by Mr. Graham, after which Mr. Anderson proposed, and Mr. Allen seconded a vote of thanks to Mr. Graham, who briefly thanked the meeting.

A similar compliment, on the motion of Mr. Smallwood, seconded by the Rev. Canon Raine, was paid to the chairman, after which the members separated.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

February 10th.—The president, Mr. T. H. Hennah, in the chair. The receipt of *Catalogue of Works on the Microscope*, by R. C. Roper, from the author, *Microscopic Objects Figured and Described*, by J. H. Martin, from the publisher, and Scientific Opinion, from the editor, was acknowledged.

The hon. sec., Mr. T. W. Wonfor, exhibited a collection of galls, found on British plants, made by Mr. W. H. Kidd, and read a description of each and of the insects producing them, drawn up by the same gentleman. This collection is intended for the Brighton Museum.

Mr. Wonfor then read a paper on "Seeds."—Commencing with the first appearance of the ovule, in the unexpanded flower bud, as a pimple consisting of an aggregation of cells, its gradual development and impregnation by the pollen together with its several parts were traced, until the perfect seed ready for dissemination, and containing within it the embryo of the future plant, was fully formed. The various modes by which the seed is disseminated, the great number produced by some plants, the power possessed by some seeds of resisting heat and cold, and the wonderful property possessed by some seeds of preserving their vitality under apparently very adverse circumstances, for long periods of years, were next discussed. On the subject of artificial selection it was pointed out what might be done in increasing both the size and number of seeds and plants, by carefully following the plan adopted with such success in the case of corn grains by Mr. F. Hallett, of Brighton. Seeds, as objects for the microscope, were next discussed. Having spent several years in the collection and examination of the seeds of wild and cultivated plants, as objects for the microscope, he considered few things in the vegetable kingdom presented such diversity of form, markings, and beauty. Although unwilling to lay down any law for classification, by means of the appearances of seeds, yet often in the case of unknown seeds, he had been able to name the family to which they belonged, from certain peculiarities common to many plants of the same family. Among some of the most interesting families might be mentioned the Scrophulariaceæ, containing the mulleins, foxgloves, figworts, paulownias, &c. the Papaveraceæ, many of which were very beautiful objects; the Caryophyllaceæ, a pink family, containing a very great number of very beautiful seeds, not the least beautiful being the common chickweed and ragged robin; and the Orchidaceæ, characterized by what had been termed the appearance of net-purses containing a single gold coin. The majority required no other preparation than that of being mounted dry. Some, like the orchids, when mounted in balsam, formed good polariscope objects. For making out the several coats of the seed and the embryo, sections cut on the plan recommended by Dr. Hallifax gave admirable results.

The paper was illustrated by a large collection of seeds, and by microscopic preparations, including sections showing the several parts, made by Dr. Hallifax.

NATURAL HISTORY SOCIETY OF GLASGOW.

The fifth meeting of the session was held on Tuesday evening, the 25th Jan., in the library of Anderson's University, Professor John Young, M.D., president, occupying the chair. Mr. John Beanmont, Garnetbank House, 310, Sauchiehall-street, was elected a resident member. The secretary exhibited a specimen of the Shore-lark (*Alauda alpestris*), which was shot near St. Andrews on the first of the present month, and forwarded by R. G. Wardlaw Ramsay, Esq., of White-hill, Lasswade. This species has hitherto been regarded as an extremely rare British bird, and in all works on the ornithology of this country not more perhaps than a dozen British specimens have been enumerated. Mr. Gray, however, remarked that during his examination of Scottish collections during the last six or eight years he had seen at least nine specimens that had been captured north of the Tweed, and even ventured to say that the shore-lark would yet be found to be a tolerably regular winter visitant to the eastern shores

of Scotland. Although the head-quarters of the species might be said to be North America, where it was widely distributed from the table-land of Mexico to the Fur Countries, extending its range as far as the shores of the Arctic Sea, it was doubtful if the small flocks which reached Britain came from that part of the world. It had not indeed been definitely settled whether the shore-lark of North America and that of European countries are really identical.

Mr. Thomas Chapman exhibited two cases containing a number of specimens of *Ceratocampa regalis*, and eight other species of interest, which had been brought alive to this country from North America in February last.

The following papers were then read:—

"On the Claims of Natural History as a Branch of Education," by J. W. Allan, Esq., in which the author advocated the teaching of zoology and other branches of natural history in schools, and also that it should occupy a more important place in the curriculum in all universities. At its close, Professor Young made some lengthened remarks bearing on the different aspects of the question.

"On the Introduction of the Wild Turkey (*Meleagris gallopavo*) into Argyllshire," by John Gilmour, Esq.—The author of this paper mentioned having received three specimens of this beautiful bird—a male and two females—from the Southern extremity of Lake Huron, in Canada, in the summer of 1866, since which time various broods had been successfully reared in the neighbourhood of Ardlamont, where the birds had been allowed their full liberty in the woods. At first it was found necessary to establish a brood by hatching the eggs under common barn-door fowls, but the young birds at once exhibited their thoroughly wild nature by refusing the shelter of a roof and preferring to roost on trees. One of the birds of this flock (reared in 1867)—a young male—Mr. Gilmour described as a very handsome bird, of beautiful plumage, his magnificent bronzed feathers showing to great advantage in the sunlight. In the summer of 1868 one of the hens had selected a site for its nest in a dense thicket of ivy, clothing the summit of a high and precipitous rock where it managed to remain unobserved until the young ones were hatched. After making the discovery of this nest, Mr. Gilmour was interested by observing the manner in which the parent bird approached her secret treasure. Taking advantage of an overhanging tree, the wary creature invariably perched there first, and, after walking cautiously along a branch, dropped upon the nest, on which she sat without the faintest trace of her form being seen. In 1869 the hen birds disappeared for a considerable time in the woods, and nothing was seen of them until each appeared with a brood of about a dozen healthy chicks feeding in the small grass paddocks at the edges of the coverts and enjoying the sunshine. While the young ones were busily engaged in feeding on insects, &c., the old birds were standing on the alert with outstretched necks ready to give the alarm on any approaching danger. On being suddenly surprised, these quick-sighted sentinels would at once crouch close to the ground with a warning cry, and remain motionless in this attitude, the young ones meanwhile disappearing as if by magic in the surrounding tufts of grass. At a later stage of their existence these broods, which spread themselves in the neighbouring moors and in the woods adjoining, were killed by shooting parties, the beaters having disturbed them along with ordinary game. Mr. Gilmour also mentioned that they in some cases squatted so close to the ground as to be quite invisible among the withered twigs and ferns, and that in one instance he had actually, in firing at a rabbit in the covert, shot a young wild turkey which had been lying concealed in the course taken by the rabbit. Mr. Gilmour concluded his highly interesting paper with a description of the wild bird as compared with those of the domestic breeds, remarking that it possessed greater symmetry and altogether a more compact form, standing higher on its legs, and exhibiting other characters more like those of a game bird than one of the gallinaceous order. The plumage of the male especially was described as of the most perfect bronze colour, gleaming in the sunshine like a splendid coat of mail. The number of eggs was stated to be from 16 to 20, and the time of incubation lasts 31 days.

In referring to the wild turkey as catalogued by scientific ornithologists, Mr. Gray mentioned to the meeting that there are now supposed to be three different species of Meleagris besides the *M. ocellata*, of Honduras and other parts of Central America, namely, *M. Americanus*, which is probably peculiar to the eastern half of North America; *M. Mexicana* of Gould, a species belonging to Mexico, and extending along the table-lands to the Rocky Mountains, the Gila, and the Llano Estacado; and a third, the *M. gallopavo* of Linnæus, or domesticated bird. This last species was perhaps originally indigenous to one or more of the West India Islands, whence it was taken in a tame state to various parts of North America, and thence to Europe about the year 1520. The domesticated bird differs from the nearly allied wild species in having a largely-developed dewlap extending from the base of the under mandible down the fore part of the neck to its base, and it cannot yet be said to be a settled question as to the precise original stock from which the valuable barn-yard breeds have descended.

"Notes on the Genera of Extinct Fossil Shells—Bellerophon and Porcellia; their Classification amongst the Mollusca, and their Distribution in the Silurian and Carboniferous Strata of the West of Scotland," by John Young, Esq.—Mr. Young stated that at one time this interesting group of shells had been placed by palæontologists among the Cephalopods, the highest divison of the Mollusca, and regarded as fossil representatives of the recent Argonautidæ, which possess a symmetrically coiled shell, as in Bellerophon and Porcellia, but, like them, not chambered as in the genus Nautilus. In the more recent classification of the Mollusca, Bellerophon and Porcellia are now placed amongst the Gasteropods, and in that division termed the Neucleobranchiata, which consist of entirely pelagic animals, some having shells, others none, and, according to Woodward, swimming at the surface instead of creeping on the bed of the sea. Professor Owen believes, however, that from the thickness of the shell in many of the species of Bellerophon, they may have been adapted to protect their owners while crawling over the sea bottom; for it can scarcely be insisted, he says, that all were necessarily floaters on account of their organization. In recent seas the extinct genera are represented by the genus Atlanta and the sub-genus Oxygyrus. In palæozoic times the genus Bellerophon commenced its existence, so far as is known, in the Lower Silurian period, and became extinct in the Carboniferous. It is represented over the world by about 70 species, 14 of which are found in Western Scotland, viz., 4 in the Silurian rocks of the Girvan valley, Ayrshire, and 10 in the carboniferous limestone strata of the districts around Glasgow—the most abundant and characteristic carboniferous species being *B. urii* and *B. decussatus*, and their varieties. The rarer genus Porcellia ranges from the Devonian to the Trias period. Ten species have been found, only one of which, however, *P. pusosi*, has yet been discovered in the limestone shales of the Glasgow district. Mr. Young concluded his paper by remarking on the very great rarity of fossil shells of this group in the strata of secondary and tertiary times.

Business being then concluded, the society adjourned till the last Tuesday of February.

CORK CUVIERIAN AND ARCHÆOLOGICAL SOCIETY.

The fourth meeting of this society for the session 1869-70 was held in the library of the Royal Cork Institution, on Wednesday evening, Feb. 2, J. Butler Brenan, Esq., R.A., V.P., in the chair.

Professor Hawkins, F.R.S., said,—Some time ago I received from a gentleman who had been resident in Australia a series of bones, which had been collected in Clifton Plains, Darling Downs, Queensland. These bones were found to consist of lower jaws of several extinct forms of kangaroos, some of which were considerably larger than the greatest of the living species of these marsupials which now inhabit Australia. Besides jaws other bones were found appertaining to these extinct kangaroos. The remains of a very much larger form of marsupials than even the extinct kangaroos were also among this collection of bones. These consisted of portions of lower jaws, also fragments of the skull, detached molar, and incised teeth, together with the articulating surface of some of the bones of the extremities. To one of the animals, of which these larger bones had formed a portion of the skeleton, Professor Owen has given the name Dipsotodon, on account of the two large tusks in the front part of the lower jaw, naming it specifically Australis, from the country which has afforded these remains. The bones which belong to this gigantic form of marsupial were first obtained by Sir Thomas Mitchell from Wellington Valley; and, subsequently, the banks of the Candamine River have been a fertile source of their remains. The character of the teeth and their arrangement at once indicate the affinity of the Dipsotodon to the kangaroos. In size, however, it far exceeded any form of this genus of animals either living or extinct. The skull of the *Dipsotodon Australis* was 3 ft. in length, and in size the molar teeth approach near to those of the rhinoceros. It also differed materially in the relative proportion of its fore and hind extremities from the kangaroo; the latter having the fore extremities of small size, while the hind extremities are largely developed. The Dipsotodon had these extremities more nearly equal in size, and in this respect somewhat resembled the Western wombak. The Dipsotodon approximated in size and bulk to the Western rhinoceros. Besides the remains of the Dipsotodon, another newly allied creature has left its remains in the mud of the banks of the Candamine River. This extinct form of marsupial has received from Professor Owen the name Nototheium, signifying "beast of the south." This genus was also of gigantic size. It differs, however, from the Dipsotodon in the comparatively small size of the lower incisor teeth. Two species of Nototheium have been found in Australia, the one named Ninerum, and the other *N. Mitchellii*.

Mr. Robert Day, jun., F.S.A., recorded the discovery during the past month by a labouring man in the county Roscommon, of a hoard of bronze fragments, weighing sixteen pounds, which he had an opportunity of examining, and the better part of which he purchased in Mullingar. The entire "find" consisted of 250 fragments, among

which portions of bronze bowls and vessels of different degrees of thickness were observable; also parts of Celts and spear-heads, and the broken portions of a bronze scabbard. The finding of this is of interest, as no such object has hitherto occurred in the British Isles. As well as can be judged from the parts that remain, it was made for one of those long daggers, wide at the base and tapering to a point, one of which, with pieces of the scabbard, were exhibited; also, three bronze celts, of the full locketted type, and some other fragments from the same find. He remarked that, from the breakage in all the pieces being of great age, none showing a recent fracture, and from the useless character of the find, the three celts being unfit for use, two having imperfect cutting edges, and the other a break in the locket, that they were intended for melting down and re-casting into more perfect weapons or implements. And this being the case, they add another link to the chain of evidence which tells us that these early bronze tools were made in this island. The greater number of the fragments were worthless, save for their metal value; and these only were brought away which could be identified as giving a character to the hoard. He also showed a small bronze dagger, locketted, resembling fig. 350, p. 465, Cat. R.I.A., and an early copper celt from Athlone.

Dr. Caulfield read a copy of a petition, which he said he found in the Public Record Office, London, presented at Whitehall on behalf of the citizens of Cork, Nov. 15, 1630, before the following members of the Privy Council, viz.:—Lord Viscount Dorchester, Lord Viscount Falkland, Lord Viscount Grandison, the Lord Bishop of London, Viscount Chamberlain, and Mr. Secretary Coke. The document is signed by "William Becher."

Mr. Hodder Westropp exhibited an ancient Irish bronze crucifix, and also a sketch of the Glasgow Bell Shrine, now in the museum of the Scottish Antiquaries, which affords a suggestion as to what purpose a crucifix had been originally applied. The Glasgow Bell Shrine is represented with a crucifix on one side of it. The crucifix exhibited was, in all probability, originally similarly placed in a bell shrine. The feet of the crucifix must have been over the key-hole, as they move as a pivot, evidently for the purpose of allowing the insertion of the key. From its bearing the so-called "jupon," which is a peculiarity of the figures of Christ of the 12th century, it must obviously belong to that date.

BOSTON (U.S.) SOCIETY OF NATURAL HISTORY.

DECEMBER 15TH, 1869.—The president in the chair. The following paper was presented:—"Notes on the Mammals of Iowa," by J. A. Allen.—The present list of the mammals of Iowa is based mainly upon notes gathered during three months spent in that State in the summer of 1867, for the purpose of collecting and studying its animals and plants. It seeming desirable to make the list a complete one, a few species have been inserted upon the authority of other authors,[1] while a few others are given from their known occurrence in nearly all the adjoining States, though not to my knowledge yet reported from this. The whole number enumerated is forty-eight, and probably but two or three remain to be added to perfect the list of the indigenous mammals of the State. Attention is also called to such others as are most likely to occur. If three or four northern ones be found to reach the northern parts of the State, the whole number, including the introduced house rats and mice, may be increased to about fifty-five or fifty-six, which is a number somewhat greater than is found in any of the Atlantic States, excluding the marine species, the seals and cetaceans.

Through the kindness of Dr. C. A. White, the able Director of the present Geological Survey of Iowa,—to whom, and to his excellent assistant, Mr. Orestes H. St. John, I am greatly indebted for assistance,—I was enabled to pass a considerable part of this time with one of his exploring parties, and to traverse large portions of nine counties.[2] These are situated a little to the south-west of the centre of the State, and embrace an area nearly sixty miles square; and to this region most of my special remarks refer. Large portions of this tract were then in a nearly primitive condition, many of its broad prairies being still undisturbed by the plough. Yet the hunter and the "first settler" had passed over it and destroyed or driven away many of the larger mammals. But the recent presence of these animals here was still fresh in the minds of the older settlers, many of whom had witnessed and assisted in their rapid extirpation.

Iowa being situated in a prairie region, it necessarily differs considerably in the general character of its fauna, and especially in respect to its mammalia, from that of the wooded portion of the United States to the eastward, as all who have given attention to the geographical distribution of animals must be aware. Yet we do not in this State fairly enter upon the so-called Middle Province of the continent, which differs so markedly, both in fauna and flora, from the Eastern Province. A great change in the fauna and flora is met with, however, at the point of junction of the wooded and woodless regions of the eastern half of the continent, which in the latitude of Iowa occurs more than a hundred miles to the eastward of that State. At this point as great and as abrupt a change occurs as usually takes place between two contiguous faunal districts, one of which lies to the north or to the south of the other, or where the line of division is an isothermal one, separating different climatic and zoological zones. A few only, if any, of the species embraced in this list seem to find their eastern limit of distribution in this State; but, with two or three exceptions, they range through southern Wisconsin, Illinois, and even into north-western Indiana and southern Michigan, or to the eastern limit of the prairies. Also, with very few exceptions, none are restricted to it in either their northward or southward range. A few of the more northern species, whose southern range is restricted to the southern border of the Alleghanian fauna, may reach the northern counties of Iowa, as a few essentially southern species may approach, or even be found occasionally within its southern borders. Iowa is hence mainly embraced within the Carolinian fauna, at least so far as its mammals, birds, and reptiles are concerned, though generally heretofore supposed to belong, in great part, at least, to the Alleghanian. Among the strictly prairie mammals represented, are at least four rodents (*Spermophilus tridecem-lineatus*, *S. Franklinii*, *Geomys bursarius*, *Hesperomys Michiganensis*), two carnivores (*Canis latrans*, *Taxidea Americana*), and at least one insectivore (*Scalops argentatus*). Only one eastern species, the red squirrel (*Sciurus Hudsonius*), appears to find at the prairie line its western limit, if, as some have supposed, it be true that this animal does not range across the continent. Hence the difference between the mammalian fauna of the prairies of the Upper Mississippi valley and that of the forest region to the eastward consists in the addition of a number of species peculiar to the prairies.

Since all the larger species of mammalia are everywhere rapidly disappearing before the revolutionising influences of civilization, and since great and general changes occur in the faunal and floral features of every country when brought under cultivation, it becomes a matter of unusual interest to preserve as correct a record as possible of the primitive conditions of our own country in this respect, for comparison with its subsequent altered status, as well as a history of the change. The natural history of Iowa is of course now far from an unexplored field, yet I find that no adequate record of its animals and plants, nor of those of the country immediately adjoining, has as yet been made. I have hence no hesitancy in presenting the few notes that follow concerning some of the mammals of this State. The author then proceeds to give a descriptive catalogue of these mammalia.

[1] The works to which I am chiefly indebted are the admirable volumes of Professor Spencer F. Baird, on the *Mammals of North America*; Audubon and Bachman's *Quadrupeds of North America*; the late Major Robert Kennicott's papers on the Mammals of Northern Illinois (See Patent Office Reports, Agriculture, for 1856 and 1857, and *Transactions of the Illinois State Agricultural Society*, vol. i. 1853-1854, p. 580); and Dr. F. V. Hayden's valuable article on the "Geology and Natural History of the Upper Missouri," published in the *Transactions of the American Philosophical Society* (vol. xii. 2nd series).

[2] Dallas, Guthrie, Boone, Greene, Carroll, Crawford, Sac, Calhoun, and Audubon.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, FEBRUARY 7TH.—At this meeting the Academy elected a correspondent in place of Sir Roderick I. Murchison, elected foreign associate.

A list of candidates for this vacancy was presented by the section in the last secret committee in the following order:—In the first line, Herr Carl Friedrich Naumann of Leipsic; in the second line, alphabetically placed, MM. Abic of Tiflis, Gustave Bischoff of Bonn, Ami Boué of Vienna, Dana of New Haven, Von Dechen of Bonn, Domeyko of Santiago, James Hall of Albany, Von Hauer of Vienna, Von Helmersen of St. Petersburg, Charles T. Jackson of Boston, Kjerulf of Christiania, Von Kokscarow of St. Petersburg, William Logan of Montreal, W. H. Miller of Cambridge, Ferdinand Roemer of Breslau, Scacchi of Naples, Angelo Sismonda of Turin, Studer of Berne. Herr Naumann received, out of 44 votes, 27; Dr. Miller, 10; Herr Studer, 5; Señor Domeyko, 2.

Among the correspondence presented as usual by M. Dumas were:—A note by M. Béchamp on blood corpuscles.

A new memoir by M. Berthelot, on the synthesis of the organic acids.

A note by M. Lenormant on the Asiatic origin of the horse and the African origin of the ass, proved by means of philological data.

A new memoir by M. Maumené on the theory of chemical action.

M. H. St. Claire Deville presented a fresh note by MM. Troost and Hautefeuille on the heat of combination of silicium with chlorine and with oxygen. The authors have obtained the following results:—One

gramme of amorphous silicium disengages 7,830 calories in uniting with oxygen, 5,630 in uniting with chlorine, and 290 in passing into the crystalline modification; and one gramme of silicium chloride evolves in reacting on 140 times its weight of water 2,915 calories. From these numbers and those obtained by the authors for carbon,[1] it will be found on calculation that one equivalent of silicium disengages more than twice as much heat as one equivalent of carbon in uniting with the same quantity of oxygen. When the carbon passes to the state of oxide of carbon only, it disengages about a third of the heat that the same weight of silicium does in passing into silica. These facts are applied by the authors to the explanation of some of the phenomena observed in metallurgical operations where silicious cast-irons are employed.

M. Faye presented a note by M. Laussedat, a note explanatory of a graphic method for determining, without the aid of calculation the different circumstances of eclipses, both solar and lunar. This method, which is only the realization of an idea of Lagrange's, may, in the opinion of M. Faye, be of use in enabling the different zones, where a given phase will be visible, to be quickly and clearly ascertained.

Observations on the zodiacal light by M. Heis were also presented by M. Faye.

Attention was called by M. H. St. Claire Deville to a very abundant fall of snow, which, according to a letter from M. Naudin, happened in Rousillon on 21st, 22nd, and 23rd ult. The snow fell without intermission for forty-four hours, and accumulated to a mean height of 1½ mètres.

M. Deville also stated that, by a letter from Gorseix, the eruption of Santorin was still active. Gaseous emanations are constantly occurring.

A note by M. Bouchotte was presented by M. E. Becquerel on a modification and simplification of Holtz's electrical machine.

A report by M. de St. Vénant was read on a work by M. Lévi, presented in 1867, the object of which is the mathematical study of the pressure of earth against walls sustaining it. In conformity with the conclusions of the report, the Academy voted the insertion of this memoir with those from foreign *savants*.

After the meeting the Academy went into secret committee.

THE VIENNA ACADEMY.

VIENNA, JANUARY 7TH.—The secretary laid before the meeting the following memoirs received:—On some constituents of the fruit of *Cerasus acida*, Borckh., by Professor Rochleder of Prague.

On a spiral valve in the *vena porta* of the Rodentia, by Herr Hofrathe and Professor Hyrtl.

Herr Haidinger presented a note from M. Meunier, of Paris, on Victorite or Enstatite from Deesa, in Chili, contained in the meteoric iron found there, which differs from other varieties in being quite colourless, and transparent, and containing not a trace of iron.[2]

Professor Unger sent in a memoir for publication in the *Sitzungsberichte* of the Academy, on the fossil reed-mace (Typha). Though recent investigations have shown the presence of the genera Typha and Sparganium in tertiary deposits, many remains of the former genus have been regarded as reeds (Arundo). The author endeavours to establish with certainty the very wide distribution for the genus Typha first indicated by D. Stur.

Herr E. Mach sent in a description of an apparatus for observing sonorous vibrations.

Dr. Samuel Kònya sent in an account of the results obtained by him of an examination of the bitter spring of Weilutza not far from Jassy in Roumania. It proves to be rich in both Glauber's and Epsom salts.

A work by Herren J. Rumpf and F. Ullik, entitled the Ullmannite (nickel-antimony pyrites) of Waldenstein in Kaernten, was sent in by Herr Professor Peters.

Dr. Graber sent in a memoir on the Orthoptera found in the level districts of the Austrian Alps.

ROYAL ACADEMY OF BELGIUM.

SCIENCE SECTION, DECEMBER 4TH.—On the report of MM. Steichen, Liagre, and Catalan, the section decided to publish in the memoirs of the Academy, a work by M. P. Gilbert, on a property of functional determinants and its application to the development of implicit functions.

The next report was on a work by M. Neuberg, entitled studies on tetrahedic co-ordinates. Following the recommendations of the reporters, the section voted the insertion of this work in the memoirs of the Academy.

THE BERLIN ACADEMY.

At a recent meeting of this Academy, a paper was read on the diathermancy of a series of bodies for obscure rays of heat, by Herr Schultz-Sellack. Most bodies are athermanous for obscure rays emitted by a surface at 100° C. coated with lamp-black; there exists, however, a certain number of substances which transmit, even when in greater thickness than one millimètre, a notable portion of rays from such a source. The principal of these are:—rock salt, fluorspar, sulphide of carbon, tincture of iodine, bromine, and sylvine or potassium chloride, that is, certain elements and certain compounds of chlorine, fluorine, and sulphur. The author has recognized the same property not only in all chlorides, but in all bromides, iodides, and fluorides of simple bodies, which he has been able to bring into a condition which permits of this form of experiment. He finds, likewise, that a certain number of sulphides possess this property.

Another interesting point ascertained by the author is that selenium, blende, chloride of silver, bromide of silver, bromide of potassium, and iodide of potassium absorb the dark rays less than those from a luminous gas flame.

ROYAL INSTITUTION OF LOMBARDY.

MILAN, DECEMBER 9TH.—The vice-president, Signor Castiglioni, read the second part of notes and observations on the instruction and education of deaf-mutes.

Professor Porta, read the concluding part of his memoir on the ligature of the large arteries.

A paper on the prevention of pellagra, was read by Dr. Lombroso.

The election of a vice-president for the year 1870-71 was then proceeded with. The following were the results of the balloting:—Brioschi, 16 votes; Verga, 3; Polli, 4. Signor Brioschi having obtained more than two-thirds of the votes, according to the requirements of the bye-laws, was therefore declared duly elected.

NOTES AND MEMORANDA.

Old Change Microscopical Society.—The handsome rooms of the City Terminus Hotel were made very gay last evening by the fourth annual *soirée* of the Old Change Microscopical Society. Thoroughly lighted, glittering with hundreds of scientific instruments, pictures, flowers, and works of art, and animated with the movement of some 1,200 ladies and gentlemen in evening dress, the scene was naturally an extremely brilliant one. As a microscopic exhibition this *conversazione* has never been surpassed. The large hall, though not sufficiently spacious to accommodate all that was to to be seen, contained the chief articles. Upon three tables, each stretching along the entire length of the hall, about 250 microscopes were arranged, one of the tables being devoted to the fine collection of instruments owned by the society itself, and the remainder to contributions from the fellows of the Royal Microscopical Society, Quekett Club, North London Naturalists' Club, and several private gentlemen and well-known manufacturers. The objects of interest were much too numerous to particularize, but a well-compiled catalogue directed the visitors to the best specimens. Insect life, as a matter of course, was familiarly dealt with in all its forms, and, in addition, there were pointed out a hair from the hapless King Theodore's head, some of Dr. Carpenter's recent dredgings from the North Sea, and a bit of human skin from the "door of the Treasury, Westminster Abbey." The vegetable and mineral kingdoms had departments of their own, and another portion of the hall was set apart for the exhibition of new and recent inventions in microscopic science.

A Monster Telescope.—Messrs. Cooke & Sons, of York, says *Applied Science*, have just completed the largest refracting telescope ever constructed. The tube, which is cigar-shaped, is 32 ft. long, and in the centre 3 ft. 6 in. diameter, whilst the object glass is 25 in. diameter. A metal pillar upon which it stands is 20 ft. high, and about 6 ft. diameter at the base. At the top of, and within the pillar, is a driving clock, the weights of which occupy the lower hollow of the same part of the instrument. The order for the telescope was given five years ago by Mr. Newall, submarine cable manufacturer, of Gateshead, into whose possession, at the latter place, it is now in course of removal. It is the intention of Mr. Newall to erect an observatory for its accomodation in Madeira.

Another New Dye.—The aniline dyes, it seems, have now a rival which not only vies with them in brilliancy and variety, but is of a less fleeting or more fixing character. The new colouring matter, according to the *Mechanics' Magazine*, is a purely vegetable extract, the plant from which it is obtained being imported from the western parts of Africa, and also from the West Indies. The colouring matter is variously treated, according to the colours required and the dyes to be prepared from it. The process of production is carried on with machinery of a special character, which has been designed by the patentees, Messrs. Walker & Co., for this manufacture.—*Builder*.

[1] See SCIENTIFIC OPINION, vol. iii. p. 157. [2] *Ibid.*, vol. ii. p. 570.

Chemical Analysis of a Sample of Extract of Meat.—An analysis of extract of meat by Herr Reichardt is given in *Dingler's Polytechnisches Journal*. The sample was prepared by a private firm, and yielded, on analysis, the following results:—Portion soluble in alcohol (of 83 per cent. strength), 80·76 per cent.; water, 16 per cent.; fatty matter, 0·2 per cent.; nitrogen, 9·99 per cent.; ash, 21·36 per cent. (containing potass, 9·0 per cent.;) soda, 2·3 per cent.; phosphoric acid, 6·1 per cent. These results, as compared with Liebig's and the Fra Bentos extracts, are stated by the author to be in favour of the extract tested by him for MM. Buschenthal & Co.

The Faraday Memorial.—The subscriptions to the Faraday memorial have only reached £1,400. A monument, it is said, is to be erected in the British Museum. This is all the present generation of Englishmen seem inclined to do to perpetuate the memory of the greatest philosopher of their time.—*Medical Times and Gazette.*

SCIENTIFIC DIARY.

WEDNESDAY, February 16th.

Society of Arts, 8 p.m. "On Emigration," by Thomas Plummer, Esq.
Royal Society of Literature, 8.30 p.m.
Meteorological Society, 7 p.m.
Royal Horticultural Society. Exhibition of Chinese Primulas and Lycastes.
Royal Society of Literature, 8.30 p.m. "Coffins and Mummies discovered in Egypt during the Visit of H.R.H. the Prince of Wales," by Dr. Birch.

THURSDAY, 17th.

Royal Society, 8.30 p.m. "On a Distinct Form of Transient Hemiopsia," by Hubert Airy, M.D. "Account of the Great Melbourne Telescope, from April, 1868, to its commencement of Operations in Australia, in 1869," by A. Le Sueur.
Society of Antiquaries, 8.30 p.m. "Ancient Monastic Inventories," by the Rev. M. E. C. Walcott. "On some Roman Antiquities," by S. Sharp, Esq., F.S.A.
Linnean Society, 8 p.m. "Tree-Ferns of British Sikkim," by Mr. Scott.
Zoological Society, 4 p.m.
Chemical Society, 8 p.m.
Numismatic Society, 7 p.m.
Royal Society Club, 6 p.m.
Harveian Society, 8 p.m. "On Infantile Pneumonia," by Dr. Day. Clinical Discussion "On Croup."
Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.
Social Science Association, 8 p.m. "Results of Government System of Railways in Belgium," by M. Corr Vander-Maeren.
Bradford Philosophical Society, 8.15 p.m. "The Talmud," by Emmanuel Deutsch, Esq.

FRIDAY, 18th.

Royal Institution, 8 p.m. "On the Theories of the Physical Forces," by Mr. Clifford.
Geological Society, 1 p.m. Anniversary meeting.
Philological Society, 8.15 p.m. "Attempt to reconcile the Laws of Latin Accent and Rhythm with those of Modern Languages," by Prof. T. Hewitt Key.
Leamington Microscopical Society, 8 p.m. For practical manipulation. Subject:—The Bee.

SATURDAY, 19th.

Royal Institution, 3 p.m. "Science of Religion," by Prof. Max Müller.
Metropolitan Association of Medical Officers of Health, 7.30 p.m. "Observations on Suggestions by Mr. Jas. Lewis for National Sickness Returns," by Dr. E. Ballard. "On Prof. von Pettenkofer's Views of the Relation of Subsoil Water to Enteric Fever," by Dr. Geo. Buchanan.

MONDAY, 21st.

London Institution, 4 p.m.
Victoria Institute, 8 p.m. "Spontaneous Generation; or, the Problem of Life," by the Rev. Prof. Kirk, of Edinburgh.
Royal Asiatic Society, 3 p.m.
Medical Society of London, 8 p.m.
Entomological Society, 7 p.m.
King's College, 8 p.m. Prof. Guy's Lectures.

TUESDAY, 22nd.

Institution of Civil Engineers, 8 p.m.
Royal Medical and Chirurgical Society, 8.30 p.m.
Ethnological Society, 8 p.m. "On Recent Archæological Discoveries in Yorkshire," by C. Monkman, Esq. "On the Natives of Naga in the Phillipine Islands," by Dr. Jagor.
Royal Institution, 3 p.m. "On the Architecture of the Human Body," by Prof. Humphry.
Manchester Literary and Philosophical Society, 7 p.m.

WEDNESDAY, 23rd.

Society of Arts, 8 p.m. "On Economy in the Use of Fuel for Domestic Purposes," by Capt. Douglas Galton, C.B.
Geological Society, 8 p.m.
British Archæological Association, 8 p.m.

Meteorological Society.—We should be glad to publish the business of the meetings if the secretary could let us know it in time.

Harveian Society.—The secretary has our thanks for the notice sent us.

The Primordial Utricle.—"C. T. W."—You are quite right as to relationship of this to the cellulose wall. It was first distinctly pointed out by the celebrated Hugo von Mohl, whose splendid monograph on the vegetable cell is translated into English.

Segmentation of the Yelk.—"B. G."—Some years ago it was thought that impregnation was necessary in order to the performance of segmentation. It has since been found in various invertebrates that segmentation is an intrinsic quality of the ovum, and takes place whether fecundation has happened or not.

Malpighian Bodies of Spleen.—"Anthropotomist" should get an ox's milt, as the butchers call it. Let him then cut out a piece about the size of his finger, and he will see the "bodies" even with the naked eye. If now he carefully crushes and washes out the pulp, he will see even under an inch power that the stalk enters the body, and this he can prove by rolling the specimen under the thick covering glass, and seeing that the stalk remains axial.

Manufacture of Glycerine.—"W. W."—Consult *Ure's Dictionary*. New edition, by Robert Hunt, F.R.S.

J. C.—The notes sent arrived a few hours too late. They should reach us not *later* than Tuesday morning. We hope to receive more *from* him soon.

M. Leverrier.—Our kind correspondent is thanked for the note. Before the letter reached us we had asked another astronomer to write an article on the subject. Hence, we are unable to publish the note. We regret the unavoidable *contretemps*, and we hope our friend will not discontinue his aid.

W. K.—Letter received; thanks.

Society of Arts.—The secretary's letter received. We are glad to do anything to favour the object of the committee.

F. B. F.—Thanks.

Colour-changes in Jupiter.—"P. D. M."—We quite agree with you. It is impossible to make satisfactory observations with large refractors, for they are insufficiently corrected. The reflector is the proper instrument. Try one of Browning's excellent silvered glass specula.

Andalusite.—"A. G."—It is not very rare. You can readily recognise it by the large brown, somewhat quadrilateral prisms in which it occurs.

Action of Heat in Metamorphism.—"Geo." should communicate with Mr. David Forbes, F.R.S., who has made several very curious synthetical experiments on this subject. Some of Mr. Forbes' specimens of rock artificially prepared, and acted on by intense heat, are most curious and suggestive.

The B. A. Unit of Electrical Resistance.—"Tyro."—Yes. This is the best test you can employ. It is now nearly universally used by scientific and practical electricians.

Leclanché Cell.—"H. C. S."—Unfortunately we do not know what the price is. We believe it is not expensive.

Brighton and Sussex Natural History Society.—"T. W. W.'s" inclosure received. Thanks.

Académie Royale de Belgique.—Last bulletin received. Thanks.

NOTICES.

Hour of Publication.—The Publishing Trade are informed that Scientific Opinion will be published at *Mid-day on Wednesday* in future.

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WEDNESDAY, FEBRUARY 23, 1870.

THE NEW MINES INSPECTION BILL.

IN the Report of the Royal Commissioners, drawn up by Michael Faraday and Sir Charles Lyell, we find these words:—"We believe, therefore, that if the education of miners generally, *and especially of those set over them*, can be materially raised, it will conduce to the security of the lives of the men and the perfection of the art of mining far more effectively than any system of Parliamentary inspection that could possibly be devised." But an opinion may be interpreted in various fashions, and we fear that the Home Secretary has misconstrued the advice which is urged in the above passage. Mr. Bruce has no doubt attempted to bring in a Bill which is intended to be a practical expression of the Commissioners' views, but we are afraid that he has only approached his subject from one side, and has hence produced a scheme of reform which is correspondingly unilateral. There can be not the faintest doubt that the words which open the article are in every sense sound and sage words, and that they convey the fruit of careful study of the conditions of mines and miners, and grave consideration of all the facts of the case. To those who know aught of practical mining it seems almost a truism to say that the education of miners and overseers will achieve more for the preservation of life than "*n quantities*"—to use a mathematical phrase—of Government inspection, especially as it is known what Government inspection is. But the question arises, To what extent is the education to be carried? and the answer which the terms of Mr. Bruce's Bill afford us is, we are sorry to say, of the most unpromising nature.

If we leave aside for the moment the politico-social part of the Bill which was read a second time on Monday night last, that, for example, which relates to the ages at which boys may be permitted to labour, and kindred points, and come to examine the clauses of the scheme which relate to the prevention of accidents in mines, we must own to grievous disappointment. From such an aspect our Home Secretary's attempt appears to us to rival the memorable Partingtonian efforts against the advance of the Atlantic; for our Minister seems to fancy that by teaching his mining population the veriest elements of knowledge he will stay or abolish the recklessness of both workmen and owners. It is true that he has rendered the latter more liable to certain penalties than heretofore, but practically the whole tenor of the new Bill is the prevention of mining disasters by teaching miners to "read and write and cipher."

It is very natural, on the old principle of "there's nothing like leather," that a member of the Government, who is so deeply engaged in framing a statute for the education of the people, should imagine that a little education would be good for the miners. And when the words of Faraday and Lyell so apparently bear him out, we have before us the *fons et origo* of the plan of legislation which was so favourably received in the Commons on Monday night. But a very little impartial reflection will show, firstly, that the education referred to by the Royal Commissioners is not the education which, so far as we can see, Mr. Bruce proposes to give the miners; and, secondly, that unless both overseers and men, and, as Lyell and Faraday said, especially the former, are educated, the whole operation of the new Act will be of none effect.

The statement made by the Home Secretary in asking to have his Bill read a second time in some measure explains to us the origin of the error, for so we must regard it, into which he has fallen. Clear as that statement was, and consecutively as it dealt with the leading defects of the existing law, it gave us the idea that in considering coal-mine disasters Mr. Bruce had before his mind but one form of accident, that resulting from explosions of firedamp. And his argument was somewhat of this kind:—"Accidents and loss of life result from explosions of this gas; the ignition is caused by the lighting of a pipe or the opening of a safety-lamp. This in its turn is the consequence of crass ignorance on the part of the miner. By my Bill I propose to remove this ignorance, and for the result, *Cela va sans dire.*"

But, unhappily for an hypothesis of this kind, there is the fact that the minority of the fatal accidents are those due to explosion; and also the question as to whether a knowledge of orthography and figures will prevent a miner's recklessnes. On the first point, it is needless to say that Mr. Bruce's Bill makes no provision. The prevention of the more serious accidents consequent on faulty construction of the mines, and indeed also from want of drainage and ventilation, must depend either on a proper technical knowledge on the part of the superintendents of the mines, or on an efficient Government inspection. Neither of these conditions exists as yet; and so, in the event of the new Bill becoming law in its present shape, our only safeguard against the fatalities of coal-mines lies in the little English grammar, caligraphy, and arithmetic which Mr. Bruce can instil into the brain of the mining population below the age of twelve years.

Such, so far, is all that Mr. Bruce has done for miners. *Au reste*, we are left with the same number (12) of Government Inspectors, and these gentlemen are only to give a cursory glance at mines, because, were it otherwise, they would have to stoop their backs in traversing some of the excavations! It is plain, then, that this Bill, which is, we fear, likely to pass, is one of the most patchwork order, and which, as its clauses now stand, would not in the slightest degree diminish the mortality from accident in our coal-mines. It is a measure in which the advice of practical men has been set considerably at naught, and which, if it is to be read a third time, should undergo very serious modification of detail. It is perfectly plain that, with the exception of Dr. Playfair, very few of those who discussed the Bill on Monday night understood its real scientific bearings. It is to be hoped, therefore, that those who realize the tendency and effect of the Home Secretary's scheme will take care that the clauses of the Bill are materially altered when it goes into Committee on the 18th of March next.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

THE Superintendent of the *Nautical Almanac* has prepared a chart of the moon's shadow-path for the eclipse of the sun on 22nd December next, and it is issued, with numerical data concerning the eclipse, as a "Nautical Almanac Circular." The shadow-path traverses Southern Spain and Northern Africa, thence passing over Sicily and Turkey in Greece. Favourable points for observing the eclipse will be Tavira, Xeres, Malaga, Oran, Batna, and Syracuse. At these the duration of totality will be about two minutes.

WE are glad to hear that the recently-formed "Observing Astronomical Society" is making satisfactory progress. There are several names of observers of eminence included in the list of its members. Mr. W. R. Birt, F.R.A.S., so well known for his valuable contributions respecting lunar matters, and others are actively supporting the society, and we have no doubt that it will

prove a great success. The observations made by the members are published monthly in that excellent periodical, the *Astronomical Register*. The Hon. Secretary, Mr. William F. Denning, Ashley-road, Bristol, will be happy to supply every information respecting the society, and has promised to forward us monthly extracts from the observations made by the members of the society.

According to the *British Medical Journal*, the council of the Hunterian Museum are in treaty with Dr. Nicolucci of Isola di Sooa for the purchase of his fine collection of Italian and Greek skulls. This collection, comprising 165 specimens of ancient and modern crania, selected with great care by the celebrated Italian ethnologist, and upon which his well-known researches into the history of the races of southern Europe have been mainly founded, will prove a valuable acquisition to the already extensive series in the Hunterian Museum.

The subjects of the prize essays of the Belgian Academy of Sciences for 1871, the programme of which reached us just too late for insertion in our last number, are—(1) A summary and simplification of the theory of Integration of Equations, having partial derivatives of the two first orders; (2) An investigation of Induced Electric Currents, based as much as possible on new experiments; (3) A determination, by new researches, of the position which the genera Lycopodium, Selaginella, Psilotum, Tmesipteris, and Phylloglossum ought to occupy in the natural series of vegetable families; (4) A description of the mode of Reproduction in Eels; (5) Some new researches to establish the composition and the mutual relations of Albuminoid Substances. The prizes will be gold medals, each of the value of £40 (1,000 francs) for the essays on the first and fifth subjects, £32 (800 francs) for the third, and £24 (600 francs) for the second and fourth. The essays are to be written legibly in either Latin, French, or Flemish. The authors of the essays inserted in the reports of the Academy will have the right to one hundred copies of their essay free, and as many additional copies as they wish at the rate of four centimes per sheet. The editions and pages of the works quoted must be given. The essays must not bear the name of the author, but a motto, to be repeated on a sealed envelope containing the name and address. The essays become the property of the Academy, but permission will be given to take copies. They are to be sent, post-paid, to M. Ad. Quetelet, Perpetual Secretary, before June 1st, 1871.

A Foundation Scholarship will be given, by an examination to be held on Saturday, April 23, and Monday, April 25, for proficiency in the following branches of natural science:—Chemistry, physics, physical geology, including meteorology and the elements of mineralogy. Any undergraduate of Cambridge or Oxford may be a candidate for this scholarship on sending his name to the Master of Trinity College, Cambridge, before Wednesday, March 30. It is tenable till the holder is of standing to take his M.A. degree.

During the recent storm, the waves which assailed the breakwater at Wick were estimated by the resident engineer at 42 ft. in height from hollow to crest. On striking the breakwater they rose to such a height as to pass in a solid mass of blue water as high as 25 to 30 ft. above the top of the parapet, which is 21 ft. above high water, while the spray rose to about 150 ft. above the parapet, and was carried by the wind as far as the old harbour, a distance of 1,500 ft. These gigantic rollers were observed to strike the pier every seven or sometimes ten minutes, and these shocks were continued without intermission for three days and nights.

The recent experiments with Harvey's "Otter" torpedo are reported to have been very successful. There is certainly no great art required for the production of a torpedo in the ordinary accepted sense of the word. But there remain the conditions that the enemy must come to the torpedo, or the latter must be taken to the enemy. Captain Harvey, R.N., meets this difficulty with his "Otter" torpedo, the one tested by Captain Boys, by taking it to the enemy with a suitably constructed and exceptionally swift towing steamer, and exploding it by contact with the bottom of the enemy's ship at a considerable distance below the water-line. Captain Harvey's torpedo in shape may be described as a parallelogram, of about twelve times its diameter in length and eight in depth, the size varying according to the work to be done. The bevelled ends of the case give it, when towed, a divergence of about 45° from the track of the vessel towing it, and this, with a tow-line of considerable length, gives a certainty of contact between the torpedo and the ship steered for, without necessitating a collision between the vessel towing the torpedo and the ship attacked. When towed, the fore end of the torpedo only shows above the surface of the water, the after end being supported by cork floats of "nun-bury" shape. When the fore end comes in sudden contact with any object, however slight the contact may be, it is deflected downwards in the water, but on the strain of the tow-line immediately rises again.

A modification of Palliser's chilled shot was made last week and put to the test at Shoeburyness. The testing, which was attended with very striking results, was carried out at Major Palliser's sole expense. This modified projectile weighed 130 lb., and contained 6 lb. of powder, and may be called a semi-chilled shell, the head only having been cast in chill, while the body was cast in sand. The object of this change is to keep the bodies of shell so soft as not to cut up the bore of the gun in case of an accidental explosion of the bursting charge. Two rifled guns, one 8 in. and the other 7 in., were employed, the charge consisting of 22 lb. of powder. The *Warrior* target, on which they were tried, was completely penetrated, the velocities of the projectiles being considerably more than sufficient to produce this effect, as determined by Captain Noble, by means of Navez's beautiful instrument.

No successor to the late Professor Graham as Master of the Mint having been made, it appears that the authorities at the Mint are without power to coin either gold or silver, and will remain so until the Bill introduced into the House of Commons providing that the Chancellor of the Exchequer for the time being shall be Master of the Mint becomes law.

The proceedings against Vrin Lucas, the author of the Chasles documents, were commenced last Wednesday, and then adjourned for a week. He is said to be 52 years of age, and imperfectly educated, but possessed of a wonderful talent for invention. He did not deny that he imposed upon M. Chasles, but pleaded in extenuation that he included with the forgeries he sold authentic documents of value fully equal to the sums he received. He admitted that he had sold to M. Chasles, at different times, no less than 27,000 documents, for which he had received from that gentleman 140,000 francs. Of these only about 100 were genuine; the rest were productions of his own pen, although purporting to be written by Julius Cæsar and other Roman emperors, by apostles, and by poets and statesmen of all ages, and had all been manufactured by himself, without the aid of any other person. In order to complete the deception he had forged annotations upon old books and documents, purporting to be made by former possessors of the manuscripts, which he palmed off upon M. Chasles; and also had recourse to various expedients to give an appearance of antiquity to the papers, by submitting them to the action of heat, and by mixing colouring matter with the ink he used. M. Chasles, upon being examined, said he was a member of the Académie des Sciences, and was 76 years old. He could not fix the date when Lucas first came to him, but it was a long time since. He introduced himself with a letter from a collector of curiosities known to M. Chasles, and produced several documents, which the latter purchased. From that time these dealings became frequent, until they reached the enormous figure admitted by the prisoner. For an alleged letter of Molière, M. Chasles paid 500 francs, and for a first letter of Rabelais 200 francs, afterwards pur-

chasing, at various prices, upwards of 2,000 bearing the same signature. Lucas also obtained money from him on different pretences of pressing need, and had also obtained books, which he never returned. Being asked by the judge how he explained the production of such documents in such numbers, M. Chasles replied that the letters explained each other. Thus, Alcium wrote to Charlemagne upon documents which he found at the Abbey of Tours. Rabelais was sent to that abbey by Francis I., from which place he wrote the letters included in the manuscripts sold by Lucas, which comprised 100 letters from Alcium and more than 2,000 from Rabelais. The detection of the prisoner's fraud arose from M. Chasles's apprehension lest Lucas should dispose of any of his valuable manuscripts out of France, and he therefore directed the attention of the police to the man's actions. Having sent a pretended letter of Galileo to Florence for examination by a commission of *savants* there, it was returned to him as a forgery. He then complained to Lucas, who gave him another letter, telling him the owner of the collection from which those documents came was a M. de Boisjardin. After the Académie des Sciences had decided that the Pascal letters were forgeries, Lucas said his employer had consulted him, and he thought the best thing would be to restore the purchase-money and take back the documents; "but this," said M. Chasles, "I would not do, as I believed in their authenticity." The prisoner was interrogated by the Court as to what he had done with the large sums of money received from M. Chasles, but he persisted in saying that he had but 2,000 or 3,000 francs left, and refused to give any account of his expenditure of the remainder. Several experts were called, as it seems rather unnecessarily, to prove the methods employed by the prisoner to give the appearance of age to the forged writings.

At a meeting last week of the Edinburgh University Court, appeals were sustained against the names of Mr. W. E. Gladstone, Dr. Lyon Playfair, and ex-Lord Provost Chambers being retained on the roll of voters of the University, on the ground that they had lost the necessary qualification by ceasing to hold offices which formerly entitled them to vote.

The question was to be asked yesterday in the House of Commons, Whether the Government are prepared to take measures for relieving the overcrowded condition of objects in the British Museum?

What a pity it is that persons will make claims upon public attention by writing about things which they have made no attempt to make themselves acquainted with! A recent instance of this practice is a correspondence in the *Malvern Advertiser*, upon a lecture by Mr. Pengelly given in Malvern. Some one signing himself "Credo" tries to defend his interpretation of the Bible record by treating the enormous mass of evidence accumulated in support of the antiquity of man as mere suppositions. Mr. W. S. Symonds and another geologist have each taken the trouble to reply to "Credo." We fear they have both wasted their time.

The following letter from Sir Samuel Baker, reporting the satisfactory progress of his expedition so far has been received:—"Khartoum, Jan. 12, 1870.—Dear Sir,—We arrived here on the 8th inst. after an unprecedented journey of thirty-two days sixteen hours from Suez to Khartoum. We were delayed seven days at Souakim for the want of camels; and one day at Berber—thus in twenty-four days and sixteen hours travelling we reached Khartoum. This rapidity of march proves the superiority of the Souakim route over that of the Koroso desert. I reviewed the troops upon my arrival here, and they are in good health and prepared for the White Nile voyage. The delay of six steamers and fifteen large vessels at the second cataract is a great disappointment. I shall push up the White Nile with 1,000 men in three steamers and fifty vessels, which are being collected here. After disembarking at Gondokoro the boats will return to Khartoum, and receive Mr. Higginbotham and the engineers who are now advancing to Khartoum by the Koroso desert with the steamers of Mr. Samuda in sections upon camels. This second branch of the expedition will follow me to Gondokoro with 700 troops. We are all well. The season healthy and cool. Troops in good spirits.—Yours truly, (Signed) Sam. W. Baker."

A new explosive is in use for blasting purposes. It is a substitute for nitro-glycerine, than which it is said to be more effective weight for weight. It is said to be much safer than nitro-glycerine, not exploding by concussion or when fired without being confined. It is the invention of Lieutenant von Dittmar, of the Prussian army, and is called "dualin."

An interesting paper was last week communicated to the Royal Irish Academy, the first of a series on "Researches in the Application of Optics to Chemistry," by the Rev. Professor Jellet, F.R.S. Having made some general preliminary remarks respecting the changes in rotation observed under the polariscope as the result of the action of acids on bases, he proceeded to the consideration of the changes effected by the action of nitric acid on quinia. From his investigations, he was able to establish the existence of an acid nitrate, or binitrate, of that base—a salt which has not as yet been isolated. He promised to make a further communication on the combinations of nitric acid with a mixture of quinia and ammonia.

The new member for Hastings, Mr. U. J. Kay-Shuttleworth, is a chemist of no mean attainments, and will, we are sure, avail himself of his position to strike a blow for the good cause of Science whenever opportunity offers.

An Imperial Commission has been sent over to this country by the Russian Government to inspect the Fairlie system of railway-working now in operation in various places, but chiefly on the Festiniog line, a wonderful little railway of two-foot gauge in Wales. It is a single line, 13¼ miles in length, with a branch of 1 mile connecting the slate-quarries of Festiniog with the quays of Portmadoc. The terminus at Festiniog has 700 ft. of elevation above that at Portmadoc, the average gradient being one in 92, which is enough to secure the descent of the trains on the return journey from Festiniog to Portmadoc by the impetus of gravitation. The line runs through a rude, rocky country, and has to adapt itself to an endless variety of curves along the contour of the hills, so that a train of any length has frequently to wriggle in serpentine fashion along two or three reverse curves, some of them sharp enough—the radius being 1¼ chains. On these curves the cant or super-elevation of the outer rails is never more than 3 in.

The last intelligence of the laying down of the telegraph cable from Bombay to Aden was quite satisfactory. This was despatched from the *Great Eastern* at noon on the 19th inst., when she was 580 miles from Bombay.

According to Mr. Samuel Wilson, the flock of ostriches placed at Longeranong by the Australian Acclimatization Society is going on well. Twelve young ones have been hatched in one nest.

Skilful Engineering.—The grandest underground work in the world is, perhaps, the Ernst August Gallery—one of the five belonging to a metal mine in the Hartz. The mouth of it is at Gittelda, in Brunswick. It is 10 ft. high, 6½ ft. wide, and has a fall three-fifths of an inch in a yard. Like a railway tunnel (but it is twice the length of the longest), it was begun simultaneously at various different points, and finished in thirteen years. The gallery is 6¾ miles in direct length; but if its lateral branches are taken into account, and a subterranean gallery navigable for boats, which opens into it, the Ernst August Gallery is not less than 15 miles long. The survey was so skilfully made, and the plans so accurately drawn, that all the junctions of the different sections fitted accurately into each other; the admirable precision of the results having been partly insured by the aid of a magnet, weighing 200 lb., which influenced the compass through the solid rock 65 ft. deep, and which was kept in one of the working places, while the compass was held in the other.—*Mining Journal.*

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

THE TERRACES OF NORWAY.

BY PROFESSOR KJERULF, OF CHRISTIANIA.

IN THREE PARTS.—PART I.

DURING a cruise in the Norwegian Fjords last summer, I was struck with the terraces occurring at the *débouchement* of most of the rivers into the Fjords, perhaps more than with any other geological phenomena I witnessed there. The terraces in question suggested various difficulties to my mind, and my visits to them did not afford me sufficient opportunities to gather that intimate local knowledge upon which alone could any chain of reasoning safely be founded. It was, therefore, a daily hope that I might come across Professor Kjerulf, who I had been informed was at that time travelling and superintending the geological survey of Norway, which before long will be one of the most interesting results of the labours of any State scientific department.

Amongst other novel experiences of Norwegian cruising, not the least striking is that of drifting about during dead calms, often so close to the shores of the fjords as to render it necessary to get out the boats and tow the vessel off, without finding bottom for hundreds of fathoms.

It was on one of these occasions that we floated lazily and helplessly on the bosom of the beautiful Sör Fjord. Beginning with a sultry and depressing haze, the morning had gradually become one of those deliciously hot summer days of which perhaps we may find some half-dozen in semi-arctic England during the course of our dreary year.

The massive precipices and steep mountain sides were mirrored in the fjord, even to the copies of bright glaciers, outpourings of the Folgefond above, mostly unsullied by the extensive moraines one sees in the Swiss ice-rivers. Above these, clouds still lingered, just concealing so much of the somewhat monotonous edge of the mountain plateau as to leave possible to the imagination the existence, beyond, of those bright peaks so common in Switzerland—that glory of the world—and, alas! so rare in the ranges of Norway.

The shrill sound of a steam-whistle in the far distance informed us of the approach of a steamer, on its way to the head of the Fjord.

Several of our party resolved to leave our clean decks, and white but then useless sails, for the grime and filth of the steamer. The Norwegians, above all people obliging, are accustomed to take up passengers at out-of-the-way places, and stop at any time for a boat. So we were rowed to the steamer, and had a delicious voyage, all but the smoke and coal-dust, to Odde, itself one of the most delightful spots I saw in Norway. Here I informed myself as to anchorage, and we returned by the same steamer. On our voyage back I espied a geological hammer peeping out of a leather bag with a nubbly outside, suggestive of fossils or minerals. Having been told by a mutual friend that I should recognize the professor as "the man with a hammer," I hoped this might prove to be his property. And so it turned out. We had what was to me a most interesting talk, and I promised to translate the following pages for him. Soon we came in sight of the *Norna*, with her square sail and all canvas set, with a fair, light wind, slipping through the water. Then we saw our gig waiting our arrival, manned by four as stalwart and willing fellows as ever bent to oars. And so ends my story.

With regard to my own labour, I have been constantly reminded of Gil Blas' uncle, the priest, who, teaching his nephew Latin, thereby became able to read his own breviary! Indeed, had it not been for the assistance of Mr. Jon Hjaltalin, of Iceland, the execution of my promise would, besides additional delay, have been even more imperfect than it is.

Professor Kjerulf has perused the proofs. For very many of his alterations, as for instance the substitution of the term "bottom" for "terminal" moraine in my translation, and other more idiomatic expressions, I must decline to be responsible. But as to correspond upon such non-essential points would have involved so great a loss of time, I have preferred to let them stand, upon his authority.—MARSHALL HALL.

IN ascending the Norwegian Valleys, one cannot fail to notice the terrace-like steps of the bottom. The floor of the valley, cut out in the mass of rocks, and filled with various deposits of clay, sand, gravel, and stones, is not observed to slope evenly from its commencement to the lower end of the valley, where it opens into the sea; but it mounts thence by steps, and where we do not follow the actual river, which does indeed often form an inclined plane, we ascend from terrace to terrace, from lower to higher plains.[1] These plains—the surfaces of which are apparently horizontal, but in reality slightly slope at the upper portion, and which at their lower end terminate usually in a steep slope of about 30°—we term TERRACES.

It seems most reasonable to suppose that these valley terraces were caused by a water surface on a level with the terraces. The largest of such water surfaces is the sea. If the sea is to be considered as the cause of all terraces, from highest to lowest, we ought here and there to be able to show marine remains, partly in heaps, partly in the terraces, from the highest, far up the valley, to the lowest, at the present seashore, and at the same time we might expect a certain uniformity in the nature of the filling up of the valley, because the same covering, the sea, would have filled the whole valley.

But marine remains are only to be found at the lower altitudes, under five to six hundred feet. At about the same altitude the nature of the bottom of the valley is evidently different, as may be distinctly seen in the geological map.

Therefore at this altitude, *i.e.*, five to six hundred feet, must be the highest beach-mark.

It will be granted that steps found lower than this are marks of the lower sea-level, as the land rose (as we are accustomed to say); whereas if we find other steps higher up, we must assign some different cause for each of these. Neither will it be difficult for the traveller to class many of these steps with respect to their situation into two large groups: (1) Those that occur in a completely open situation; (2) Those comparatively closed in, and partially supported by the damming produced by the mountains on both sides approaching each other.

The maritime steps proper are all open.

The inland steps almost all distinctly closed.

Since 1858, when I first began a series of observations on those loose coverings, I have pointed out three classes of the immediate causes of steps in the watercourses.

1. The former position of the sea, which left its highest marks on the land at 600 ft. above the present level.

2. Ancient bottom moraines,[2] which obstructed the valley at a time subsequent to the glacial period, creating dams, so that a basin could be formed in the watercourse.

3. Obstruction by a mountain which might create a basin so long as the course in the valley did not erode still deeper into the dam.

The ancient highest beach-mark is tolerably evident to the observer. Below this mark are found here and there

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[1] I have mentioned the most distinct of these steps, namely, those which indicate the sea boundaries in the different valleys, in a short pamphlet attached to the geological map of Southern Norway. Christiania, 1865, pp. 7, 8. I have also given a more extended list of various kinds of terraces in my *Mineral Kingdom and Mountain Science*. Christiania, 1865, pp. 226, 239.

[2] With respect to bottom moraines, too much overlooked in comparison with the superficial moraines first meeting the eye, I must refer the reader to my *Mineral Kingdom and Mountain Science*, p. 99.

marine remains. Whenever "shell marl" has been presented from a more elevated situation, it has appeared that the shells belonged to freshwater formations, and not to marine; and when a rumour has arisen of freshwater shells on the great mountains no one has been willing to confess himself the author of such ill-supported statements. But this is not all; the nature of the whole bottom of many of our valleys and valley-plains changes distinctly at this step as at a boundary, Above this boundary strata of clay become scarcer and scarcer. and the bottom of the valley is covered either by floodsand or compact gravel and stones. Lower down we find extensive flats of clay, still partly covered with the same flood-sand brought from the interior; so that, on digging up the surface, one finds clay at the bottom and sand on the top.

It is, therefore, my opinion that the ultimate causes of the steps of the watercourses are not different, but that there was one main cause, namely, the presence of a water surface, which caused the materials washed down by the streams to be heaped up everywhere to the height marked out.

Where the watercourse joined the sea without any obstruction, the materials brought down through the valley might be piled to a corresponding height at this level and below it, as may daily be witnessed at Havstokken, or at the Oere (tongues of land or deltas), which lie at the mouth of many a valley.[3]

Where, however, a bottom moraine obstructs the passage, forming a compact wall of gravel, stones, sand, and clay intermingled, a basin may be formed inside this wall, and the material of the watercourses piled as high as the sill, so to speak. A similar case is the obstruction caused by the spur of a mountain.

Now, let us suppose the sea-level lowered, the dam broken through, or the mountain obstruction opened; at each of those spots some portion of the piled-up materials will remain at the sides of the passage, subsequently to be dug out by the water, or else the terraces will show the former water-level.

In the eastern part of Norway the main valleys are long, and open out upon extensive plains, and a comprehensive view of them is not so easily gained as in the narrow valleys of the west. Still, the most elevated step corresponding to the ancient sea-level can, in most places, be pointed out with great certainty by certain circumstances.

In the northern and western parts, where the valleys are shorter and have a steeper gradient, it is much easier to identify the many steps, which in every valley follow each other in quick succession, from the present sea-level to a certain height, beyond which they entirely disappear.

Now, as that particular most elevated step, which we can place in round numbers at a height of 600 ft. above the present sea-level, could not lie dry before our eyes in the form of a terrace, had there not been a change in the relative position of land and sea, which, up to the present time, we have thought to be best explained by the "rising of the land," it is plain that the lower steps also must be connected with this upheaval.

It has been thought that the following proposition might be maintained:—Scandinavia rises, or the rocky foundations of the peninsula lift themselves directly out of the sea. That it has risen is evident from the marine remains that are found in strata of sand and clay, or in entire shell-banks.

But several very telling facts have been appealed to, speaking for a rising now going on. Sounds have become more shallow; harbours had to be re-established further out; islets became higher; rocks appeared above the sea, where breakers had seldom betrayed their existence; marks cut out in the borders of the sea now seem to stand higher than of yore. Swedish investigators have long since tried to show that the coast of Sweden along the bay of Finland rises, and that this rising is greater the farther north we proceed, whilst at Stockholm and further south there is little or none.

As regards the coast of Norway, no such definitive assertions have been put forth.

Those statements concerning the upheaval of the east coast of Scandinavia have, however, given rise to an error which has been repeated by author after author in foreign works, that the upheaval *has been proved* to be greatest at the most northern point of Scandinavia.

At the North Cape, they say, the rising of the land is 5 ft. in a century. This has been made the starting-point, and authors have said, the rising being 5 ft. at the North Cape, and nothing in the south, gives an average of 2½ ft., and this they accept as the measure of the upheaval of Scandinavia.[4] At the North Cape, however, as well as along the entire northern seaboard of Norway, Professor Keilhau failed to discover any reliable evidences of actual rising, and it does not sound well in the ears of us Northern men to hear the North Cape mentioned as the main support of figures on the basis of which has been raised an immense computation of geological time. This single still unproved assertion, however, concerning the North Cape cannot weaken our convictions as to the upheaval of the land.

To this upheaval has been annexed the question of the glacial epoch. It has been supposed that icebergs drifting in the Polar Sea have been observed to scour and scrape the bottom before becoming fast grounded; and, as these icebergs have been seen to carry smaller blocks on their backs, Sir Charles Lyell long since gave out that our mountains were abraded, and our erratic blocks spread about through the assistance of icebergs, as, perhaps, drifting from the pole in an ocean current, they grated upon the rocky bottom, and carried away its stones as Scandinavia rose.

This able theory met with general acceptance; it is now, however, more and more abandoned; but the computation of time still boasts of the immense periods required by the theory, for the land to sink 6,000 ft. into the cold sea, and emerge again to the same height! Before we admit so vast a proposition we may demand that evidence should be pointed out of the former position of the sea at so great an altitude. It has never been possible to point to indisputable maritime remains as such evidence. All that could be shown at these altitudes was limited to certain layers of sand and gravel heaped up in flats (the stratified drifts of English geologists) in some of the fillings-up of our valleys, and therefore to some of our terraces. Whence, even from this point of view, we return to those terraces. The rising of Scandinavia has been connected with the glacial epoch by the assistance of the theory referred to for a calculation as to the length of time.

Ten years ago, supported by observations of the marks of abrasion (scouring), of erratic blocks, of ancient moraines, and also by the observed spreading of marine and inland clay over the plains and valley bottoms, I attempted to show (adopting the inland glaciation theory, and having Dr. Rink's description of Greenland chiefly in view) that only a comparatively small part of Norway was under this cold sea-covering during the glacial epoch.[5]

The distinct former sea-bottom, the marine group, disappears with all its branches, at an altitude of five to six hundred feet, and it is at about this elevation that we meet with the most marked and prominent of all the steps in our valley courses.

This assertion was in direct opposition to the iceberg theory, as explained by Lyell, which supposed far greater motion upwards and downwards. On account of this statement, Lyell has since acknowledged[6] that the greater portion

[3] As a yachtsman, I have often looked out for such spots, since, where such do not occur, any anchorage at all is problematical. It would be hard to find any men less informed in matters concerning their business than our three Norsk pilots seemed to be.—TRANSLATOR.

[4] *Antiquity of Man*, c. iii. p. 58.

[5] First, in *Polytekniek Tiddskrift* (Christiania, 1858, Nos. 21, 22), in which I refer to the excellent Swedish investigation of the Upsala districts, which was of great assistance to me in the division of the ground. Then, in two essays on "The Phenomena of Friction," in which the untenability of Lyell's theory is shown, and "On the Glacial Formation in Southern Christiania," where, for the first time, a distinction is made between the older glacial group and its branches, and the more recent post-glacial group with other branches. Both essays are to be found in a *University Programme*, Christiania, 1860, first half-year.

[6] *Antiquity of Man*, second edition p. 234.

of the land probably was above the sea-level, yet he was not willing to limit his asserted sinking and rising of 6,000 ft. to a simple rising of 600; for he considers the adoption of such height is supported by marine shells happening to occur in such places. And it is evidently his opinion simply that we have missed marine remains at greater altitudes. The whole determination of height with the assistance of marine shells is, according to Lyell's opinion, dependent upon negative arguments. To this, of course, the reply[7] is that our assertions are confirmed, not only by the chance finding of marine shells, but by the state of the ground in our valleys—pure positive facts.

For our parts, we confidently adhere to the belief that the land has only risen 600 ft. since the Glacial Epoch, till some one shall point out with certainty strata of clay or sand containing marine remains, as also indisputable marine shell-banks, at greater elevations,—since the *onus probandi* certainly rests with those who assert the contrary.—*Translated from the Norsk.*

THE BARRACOUTA.

BY JOHN RAMSAY GORDON.

THE barracouta, or barracuda, a species of pike, is a fish which abounds in tropical seas. According to Webster, it is termed in ichthyology, *Sphyræna barracuda*. It is found principally in the waters surrounding the West India and Bahama groups of islands. In the Spanish colonies it has received the name, Paricotas, and in the French, Becayune. The fish varies in length from 6 in. to 10 ft.; it is very voracious, and has been known to devour its own species. Like the pike, it is long and narrow, is very swift in its movements, and can take its prey instantaneously. Its mouth is capacious and is provided with sharp teeth in both jaws. Though the barracouta is greedy it is very subtle, and will look two or three times at a bait before it will take it; but if it once lays hold it is sure to be captured, as it closes its mouth with such force that the hook enters it securely.

The manner of taking this fish is by trolling with a live bait—usually a small fish—and this is termed by the natives of the islands "towing for barracoutas." It is necessary that the boat used for this purpose should move very rapidly through the water and as noiselessly as possible. The line must be strong, as the fish is very powerful, and the hook ought to be firmly attached to it by means of a long piece of wire about 4 ft. in length. This is termed by the natives "a tail wire." If the hook were fastened to the cord without the wire the fish would cut it away immediately.

The boat having been set in motion, no time transpires before a gentle tug is felt at the line, and upon the increase of its speed, the resistance of the ensnared fish is felt very strong. To prevent the line from breaking, more of it is run out slowly, until it is deemed necessary to pull the captive on board.

The barracouta, unlike most fish, can take its prey without turning on its side, as its superior jaw is shorter than the inferior, and, on this account, it is extremely dangerous to persons who happen to enter the water where it abounds; like other fish, did it turn on its side to seize the object of its desire, the scales would glitter and so give warning to its unwary victim. This voracious tyrant rarely goes to the bottom; its domain is in midwater, where it can capture the innocent fry which swarm the sea at certain periods of the year.

I have thought that it was unnecessary to describe the appearance of the barracouta, because it resembles exactly the pike, which is universally known.

The negroes are afraid to eat the flesh of the barracouta; they assert that it is not safe to use it as food, because it is poisonous at certain seasons, and the explanation they give of this peculiarity is that it feeds at stated times in the vicinity of copper banks or veins running in the bottom of the sea. It is said, too, that sprats are poisonous at times, and the French writer, Pierre L'Abbat, who visited the West Indies, seems to have thought that this was wholly the cause of the barracouta possessing this deadly quality. He says that the sprats feed upon the mangenele-apple, which is exceedingly poisonous, and they are swallowed by this tyrant of the sea, thereby conveying the effects to those who partake of this fish. Now, it so happens that the mangenele bears its fruit at the very time when the fish is deemed poisonous; and, it is more likely that this is the cause than that copper veins should effect this change in the fish. Some persons, however, are regardless of fear, and, after having pickled the fish, they eat it indiscriminately.

I am not aware that the barracouta is in any way serviceable, and I believe it is captured more on account of the sport it affords than for any remuneration which it might render.—*Scientific American.*

MODERN AGENTS FOR ANÆSTHESIA.

BY B. W. RICHARDSON, M.D., F.R.S.

THE original chemical bodies, nitrous oxide gas and sulphuric ether, have, notwithstanding much opposition and many advancements of rivals, retained a certain fair position as anæsthetics. Nitrous oxide, indeed, has of late been greatly extolled and raised into fervour of favour by the members of the dental profession. Ether has been persistently employed in some parts of America and some parts of France, and its friends have quite recently claimed for it that it has not been the cause of one single death.

It is right that the members of the public, who, in common parlance, know only that sometimes they or theirs may have to be put "under chloroform," should know these and all other facts correctly and intelligently; should know what agents are used and the relative value of each agent in respect to practicability of administration, certainty of action, and freedom from risk. I will essay, therefore, to bring these points clearly forward, not hurriedly and not with such exceeding brevity as to lose myself in obscurity.

Of the various agents that may fairly come under consideration, I will confine what has to be said, in the first instance, to substances which produce general insensibility, and of these I will name none that have not been tried, and for some valid reason or other been found wanting in some essential quality.

Nitrous oxide and sulphuric ether, in their respective ways, represent what are considered to be the physical requirements of agents for the production of anæsthetic sleep. The idea now is well-nigh universal, that the agent must either be a gas, as nitrous oxide is, or a liquid very easily transformable into vapour, as ether is. These, I say, are conceded points, and are based on the belief that the best and readiest mode of producing the general sleep of insensibility, is letting the narcotic enter the system by the channel of the lung; by presenting to the blood as it flows over the lung from the right to the left side of the heart, some substance which the blood will absorb and will carry direct to the nervous centres in quick and steady stream. It is true we can produce the effect we want in another way, by another mode of entrance. For example, I have recently found it quite possible and easy to put an animal profoundly under chloroform, by inserting that substance, in its fluid state, beneath the skin with a fine needle, and this method could be applied to any soluble narcotic; but as a general principle, it is not so good a method as that of administering by what is called "inhalation."

[7] *Zeitschrift d. Deutsch-geologisches Gesellschaft*, 1863, p. 627. In the same essay, which is an extract from the one quoted above on the glacial formation, namely, from that portion which treats of "general circumstances," some later additions are to be found.

We may put, therefore, in classification all the modern agents we employ under two general heads of Gases and Volatile Fluids, and I will set the most reliable substances in this order, adding to the name of each substance its chemical composition and physical characteristics.

TABLE I.—GASES.

Name.	Chem. Comp.	Density H_2=1.
Nitrous oxide	N_2O	22
Methylic ether	C_2H_6O	23
Chloride of methyl	CH_3Cl	25·25

TABLE II.—VOLATILE FLUIDS.

Name.	Chem. Comp.	Boiling Point.	Vapour Density H_2=1.
Ethylic ether	$C_4H_{10}O$	92°F	37
Bichloride of ethylene (Dutch liquid)	$C_2H_4Cl_2$	175°F	49·5
Bichloride of methylene	CH_2Cl_2	104°F	42·5
Terchloride of formyl (chloroform)	$CHCl_3$	142°F	59·75
Tetrachloride of carbon	CCl_4	172°F	77

I might expand these tables very largely. To the gases I might add carburetted hydrogen, light and heavy; carbonic acid, carbonic oxide, and hydrogen gas. To the liquids I might add methylic alcohol, chloride of ethyl, hydride of amyl, amylene, and many others, not omitting turpentine, which, at a push, has actually been administered successfully to the human subject. It is better to take simple types of those agents which are most direct in action, or most in use at this hour. Respecting those agents noted in our tables, it may be well to say of them at once, that, although they are the best up to the present time discovered, not one of them is to be considered perfect. All the gases are faulty, because, being gases, they are practically unmanageable for ordinary application. Nitrous oxide gas, moreover, although it produces insensibility, causes, at the same time, darkening of the arterial blood, painfully rapid breathing, a countenance terrible to behold, and imminent approach to death. The liquids, on their side, are practical for administration, but more or less faulty in action.

At a future day, keeping to the same text, I will endeavour to point out the relative advantages and disadvantages of each of these agents in detail; and will try to explain what is wanted in an anæsthetic agent to make it in all respects perfect; and when I say perfect, I mean so perfect that the removal of sensibility, and thereby the prevention of suffering by it, shall be attended with no anxiety, and with no sign or symptom that shall excite in the operator and administrator the anxiety which every administration hitherto has called forth.—*Popular Science Review.*

ON THE BOTANY OF CANADA AND ADJACENT PARTS OF BRITISH AMERICA.

BY PROFESSOR LAWSON,

Dalhousie College, Halifax, Nova Scotia.

IN this paper the author gives the general characters of the natural order Ranunculaceæ, the characters of the different genera embraced in the order, their synonymy and their distribution through all the provinces, as well as in other countries. Several plants that have been described as Canadian are shown to have been so recorded through mistakes, and many unsettled points are suggested for investigation. Of Clematis, he says, we have two species, one local and the other general in its distribution, viz., *C. Virginiana*, which grows around the rifle range at Bedford, and also at Windsor, Nova Scotia; it extends to Lake Winnipeg, Isle Verte being its last point north-eastwardly. Pulsatilla is confined to the north-west, whence numerous specimens have been received from Governor McTavish. The common form of the species named *P. Nuttaliana* is now known to be identical with *P. Wolfgangiana* of the Russian botanists, which is itself a variety of the European *P. patens*. Two forms from the north-west are described, one of which does not accord with Regel's Wolfgangiana. *Anemone dichotoma* is shown to be the proper name for the plant hitherto known as *A. Pennsylvanica*. Of *A. nemorosa*, the windflower of English forests, four varieties are described as inhabiting the dominion, one a small northern form, and another found at Belleville by Mr. Macoun. *A. Richardsonii* has been received only from the Hudson's Bay territories. *A. hepatica* is shown to be an essentially an Ontarian and New England plant, although found to extend into Nova Scotia, having been gathered at Windsor by Professor How. *A. acutiloba* is restricted and more northern in range. *A. narcissiflora* is not known to exist within British America, although it occurs in the United States in the Rocky Mountains. *A. parviflora* is a north-western plant, and is found also at Gaspé, by Dr. Bell, of Montreal, and on Anticosti, and is found to have usually five, not six petals, as described. *A. multifida* has not yet been collected in Canada, except on the Gulf shore, and in the north-west, but will probably reward some diligent searcher in Ontario. *A. Pennsylvanica* has a wide and southern range. *A. cylindrica*, a sand-hill plant, is confined to central and western Ontario.

Syndesmon is a curious little plant, a link between the windflowers and meadow rues, but has only been found in two localities, although in the adjoining States it is not rare; its Canadian *habitats* are St. David's and Hamilton.

Thalictrum cornuti is a stately plant, with large masses of showy white blossoms, rendering it conspicuous along the Sackville river, and on the meadows at Beaver Bank, and is of general distribution throughout the dominion. *T. purpurescens*, differing in its sessile stem-leaves, greenish flowers and drooping anthers, is to be looked for in dry situations; its record as Lower Canadian is, however, a mistake, and possibly it does not reach so far north as the St. Lawrence. *T. dioicum* has a wide range; but there are two distinct forms about Kingston which require further investigation, one growing near Kingston Mills, and the other at the Penitentiary. *T. Alpinum*, an Arctic European plant, is confined with us to Anticosti and Newfoundland; it is general within the Arctic circle, and runs down the Rocky Mountains to low latitudes, as Arctic plants are apt to do. *T. clavatum* is a York Factory plant, remarkable for its pod-like stipitate carpels, without furrows, but with embossed veins.

Of Ranunculus, eighteen species are described, and one excluded. *R. repens* is the most common, as a weed, but rare as an indigenous plant, in which character it grows near Toronto. *R. bulbosus* has been frequently reported as Canadian, but the evidence is doubtful. *R. ovalis*, *R. brevicaulis*, and *R. cardiophyllus* are referred to *R. rhomboideus*. *R. auricomus* does not belong to our flora, and *R. affinis*, here considered as a variety of it, is confined to the Arctic Sea and the north-west Hudson's Bay territories. Of *R. abortivus* two varieties (*pratensis* and *sylvaticus*) are described. *R. nivalis* was found by Dr. Rae at Repulse Bay, and the specimens agree with *R. sulphureus* of Solander. *R. Cymbalaria* is a sea-shore plant. The numerous varieties of *R. multifidus* and *R. aquatilis* still require careful comparison in the living state with European forms. *R. digitatus* is a Rocky Mountain plant, approaching *R. ficaria* of Europe. *Trollius laxus* has not been recently found in Canada. *Aquilegia Canadensis* presents two forms, and abounds in Ontario, but becomes scarce eastward and northward; it will probably be found in Annapolis, if anywhere in Nova Scotia. *A. brevistyla* is quite western, and does not come so far east as to enter the province of Ontario. *A. vulgaris*, on the other hand, is confined to Nova Scotia, but is only an introduced plant, one of the wildflowers of England, brought, long years ago, by the Duke of Kent, and now widely spread through the woods and along our railway banks and roadsides. *Delphinium exaltatum* is from the Youcon and Clear Water River, although in the States its distribution is decidedly southern. *D. zurcum* is also from the Youcon; *D. Consolida*, an introduced European plant, found at Prescott, and *D. Ajacis*,

an excluded species, not permanently naturalized. *Aconitum delphinifolium* is kept distinct from *A. napellus*, of which Dr. Regel describes no fewer than forty varieties and forms, all named and classified. *A. semigaleatum*, not previously noticed as American, is considered a distinct variety of *A. delphinifolium*; the specimens of both are from Governor McTavish. *A. napellus* is merely a naturalized plant. Cimicifuga is confined to Cayuga, in the extreme south-west of Canada, where it was found by Dr. Maclagan. *Actæa rubra* is widely spread throughout the whole dominion, but *A. alba* is south-western. *Hydrastis Canadensis* is confined to Ontario, and *Adonis* is excluded, as the specimens sent to Hooker from Labrador, thirty or forty years ago, had no doubt sprung from seeds dropped there by accident, and the plant has not been heard of or seen since.—*Read before the last Meeting of the Edinburgh Botanic Society.*

THE HEAT OF THE STARS.

ASTRONOMY has not been content with the discovery that the stellar heat can be felt, but has faced the more arduous problem of *measuring* that heat. Worthy of the task has been the instrument with which it has been undertaken. The great equatorial of the Greenwich Observatory is perhaps surpassed by no telescope in the world as regards the optical qualities which the astronomer delights in. Constructed by the same eminent opticians who made both the famous Poulkova refractor and the telescope which has done such distinguished service in the cause of science at Cambridge, U.S., and not inferior to either of those telescopes either in size or quality, this splendid instrument has been mounted in a manner which does infinite credit to the mechanical ingenuity of our Astronomer Royal. A corps of observers and mathematicians, unsurpassed perhaps in the world, garrisons the noble Observatory in which it is placed. With a liberality which cannot be too highly praised (and which might with advantage, perhaps, be extended more widely), Government has taken care that the chief national Observatory shall be so provided for, in all respects, as worthily to support the national reputation. Future ages will doubtless record a long list of physical researches in which the powers of the noble equatorial of our nobly-furnished Observatory shall have been employed by the skilful and practised astronomers now gathered at Greenwich.

Its first great achievement in this special direction is one of which our country may well be proud. Many months since Mr. Stone, F.R.S., the chief assistant at Greenwich, and already known to fame for his successful attacks upon the problem of the sun's distance, turned his thoughts towards the application of the powers of the great equatorial to the determination of stellar heat. The results he then attained, though highly interesting, did not become widely known, Mr. Huggins having anticipated their publication by communicating to the Royal Society his own successful treatment of the same problem. But, as we have said, it was the simple fact that we do receive heat from the stars, not a quantitative estimate of their heating powers, which was then laid before the scientific world. Mr. Stone hoped to be able to announce the actual amount of heat which the first-class stars send to this globe on which we live.

A little consideration will show the enormous difficulty of the problem. A very delicate thermometer placed at night in the open air responds to a thousand influences which the ordinary observer would be inclined wholly to disregard. Long ago, Gilbert White of Selborne, noticed how the thermometer rises at night as clouds pass overhead, and sinks as the heavens grow clearer. But as the science of meteorology has progressed, men have recognized the fact that changes much less obvious than these affect the thermometer. On each of two different nights the sky may be beautifully clear, the floor of heaven "thick inlaid with patines of bright gold," and yet the condition of the air may be so different that on one night the earth's heat may be rapidly radiating into space, while on the other an unseen presence in mid-air checks the escaping heat and makes the weather warm and genial. Though on each night "the heavens break open to their highest," there is thus the most essential difference in the circumstances under which the stellar heat would be measured, since the same aqueous but unseen veil which cuts off the escaping earth-heat, must in part, at least, influence the heat which is sent to the earth from beyond the stellar spaces.

By an ingenious arrangement Mr. Stone was enabled to overcome this difficulty in great part, and to secure that which so delighteth the soul of the man of science, a reliable zero. Let not the uninitiated be confounded by this mystic word,—it implies merely that which may be compared to the end of a rule or measuring-tape. To know if a star sends us heat at any moment we must know what heat our instruments would show before receiving the star's heat; otherwise, what are we to measure from? But, as we have said, this initial heat is continually varying. What Mr. Stone had first to do then was to master this difficulty. Others remained which we have not space to specify, but these also he overcame.

At last, after enormous labour, the heat received from two well-known stars has been measured. Arcturus, the leading brilliant of the Herdsman, and Vega, the chief star of the Lyre, are the two orbs dealt with by Mr. Stone. From a careful measurement of their light, Sir John Herschel long since determined that these stars are of equal splendour; but Arcturus shines with a ruddy yellow light, while Vega exhibits a colour which has been compared to the gleam of highly-polished steel. The estimates of their heat correspond with the aspect of these orbs. The fiery Arcturus sends us about twice as much heat as the bluish Vega. Minute indeed is the quantity of heat received from either star, even Arcturus having a direct heating effect corresponding to but about the 800,000th part of a degree Fahrenheit. Or, Mr. Stone remarks, the result may be otherwise stated as follows:—The heat received from Arcturus is sensibly the same as that from the face of a 3-in. iron cube full of boiling water at a distance of 383 yards.

To the worlds which circle around these brilliant stars our sun doubtless supplies no larger a degree of heat; nay, we have good reason to believe that he is relatively an insignificant orb. Around Arcturus are well-warmed worlds, nourished by the rays which belong to the red end of the spectrum. Those which circle around Vega, if equally distant, are less plentifully supplied with heat, On the other hand, if one may speculate so confidently as to the state of these worlds as to regard photography as an art practised among their inhabitants, then must the people warmed by Arcturus sit longer for their portraits than those on whom the brilliant Vega pours his powerful actinic rays. Seriously, the researches we have been dealing with suggest strange thoughts for our consideration.—*The Spectator.*

MANUFACTURE OF ELASTIC SPONGE.

THE raw sponge is received in hard, dirty masses, filled with sand and bits of shell. Being soaked in a large tank of water, it expands into such condition that its quality may be determined, and it is sorted into two kinds—the "soft" for mattress stock, and the "hard" for cushions. The cleansing process, which is an exceedingly important one, then begins in another room. In order to effect this, the sponge is first cut and washed, by passing for an hour through a huge tub, in which there is a series of knives through which the sponge is made to pass by means of the movement given to the water by a wheel. The water, too, is constantly changing, so by this process the sponge is nicely cut, and its filth separated in part. It is next soaked for twenty minutes

in a tank of water, containing two degrees (hydrometer) of soda ash, and heated to 150°. It is next passed into a tank containing a hot solution of very strong detergent soap, where it is soaked for half an hour with constant and violent agitation. It then returns to the first tub, where it is washed another hour and cut more finely.

The cleansing process is then complete, and after the water has been pressed out by a passage through rollers, it is carried by the elevator to the "drying-room," two stories above, where a high degree of temperature is maintained, and it is dried in large revolving cylinders. It is then clean and without smell, but hard and inelastic in character, and in its present condition totally valueless for the purpose of stuffing. It was at this point that the inventor's skill was necessary. The pores of the sponge closed when the water had evaporated, and no permanent elasticity could be had unless these could be held open permanently. Glycerin, being a non-evaporative substance, was found to answer the purpose. The remainder of the process is, then, as follows:—

The dry hard sponge is placed in a solution of glycerin and water, in the proportion of about half and half, and after passing through heavy rollers it is again dried in the cylinders. The aqueous portion then evaporates, and leaves the bits of sponge dry and sweet, and so permeated with the glycerin, that a permanent elasticity is maintained. It is then at last taken to the packing-room, highly compressed into bales of about forty pounds each, and is ready for market. It will be seen upon examination that the principle of the manufacture is very simple; it is necessary only to cleanse and saturate with glycerin, but the working out of the details by which these two ends have been performed satisfactorily, has been the work of years. Elastic sponge, like all novelties, has had its lessons to learn, and its drawbacks. These were natural consequences of its novelty, and were necessities. An invention is never born perfect. Just as a child must grow from infancy to maturity, so an invention of a novel character must improve by age and experience before it can succeed to perfection. But the days of its experiments seem to be over, and it has settled down into a standard article upon which reliance can be placed. —*The Hub, U.S.*

FOOD AND DISEASE.

BY PROF. JOHN GAMGEE.

IN TWO PARTS.—PART II.

AN article bristling with figures is often laid aside by those who ought to learn the truth on these subjects; but, without reference to tedious statistics, it is easy to prove that the deterioration in quality and quantity in the animal food available for our people began thirty years since, and has continued.

All well-informed persons will admit that outbreaks of foot and mouth disease such as we experienced in 1839, 1840, and almost every year up to that of 1869, have led to an annual loss of several millions—some say five, others seven—in meat and milk. The loss is irreparable; and there is no compensating condition. Every million sterling lost means something like the loss of 150,000 tons of animal food. It means more; but we have all to gain by under-stating the case. Foot and mouth disease often leads to a waste of more tons of milk than meat; and our large towns, once provided with some milk even for the poorest, have been deprived of the very aliment, the want of which could not fail to affect in the most serious manner our infant population. The days were when the poor of London, Edinburgh, Dublin, and other towns, could have a supply of milk for their children. The foot and mouth disease stopped that.

Any one having the patience for an independent inquiry, will find that the waste in milk among cows, and of flesh on steers made ready for the butcher, caused by epizootic aphtha, or foot and mouth disease, has, during the past thirty years, robbed our people of not less than between two and three million tons of animal food. A practical farmer has stated the money loss at £250,000,000 sterling. My estimate would allow nearly £100 a ton for wholesome animal food.

I have thus only dealt with a benignant and non-fatal epizootic; and yet it is in more ways than one most dangerous in its results,—it is communicable to man. Medical men have, it is true, failed to discern any great connection between human and cattle diseases. They have not witnessed eruptions to any extent amongst children fed on the milk of sick cows, but such eruptions do occur; diarrhœa is a frequent sign of the human disorder; and when we consider that Jacob and Hertwig boldly drank the milk of a sick cow, and took the disease, it must be admitted that infants are more likely to be injured than strong men. The observations recorded are too numerous and circumstantial to admit of any other interpretation than that human beings occasionally suffer from foot and mouth disease. Unfortunately, in medicine, the direct relation of cause and effect is not often ascertained with care and promptitude. Is it not a rule, rather than an exception, that the causes of infantile derangement are involved in mystery? We may hereafter enlarge on this subject, and shall, therefore, proceed to consider the losses sustained by pleuro-pneumonia in cattle.

Eighteen years since, frequent visits to London dairies disclosed a condition of things of which I had heard and read no description, and which riveted my attention to the subject of cattle plagues. In one week I saw from a yard near Golden-square twenty-one dead animals carted out of cattle-sheds containing on an average 200 cows. The old system of town dairy-keeping had scarcely died out. In some of the stables a bull was kept, and the cows turned out when dry to calve, and gain some vitality for another season's life in London. But the busy disease rendered impossible a practice that a few years before was almost universal. It is true that a cowkeeper would, in bygone days, purchase old cows who had served the breeder's turn in the country, and could live their last year or two in a mews or a cellar. In 1830 a town cow might be considered good for three or four years, yielding a calf annually, and a large quantity of milk. In 1850, pleuro-pneumonia had reduced the average duration of a town cow's life to *six months*. The good breeding cow in moderate condition, once common in Smithfield market, was replaced by fat short-horns, "fit to kill" so soon as loss of milk and a grunt indicated the fatal complaint. Thousands and tens of thousands have annually been driven or carted out of town dairies sick, for human consumption, within two months of the date of their purchase in a public market. And this has been dignified by the name of "salvage."

The cows I so often saw removed sick from the London sheds, nearly twenty years since, went to the butcher. Their carcases were "polished,"—that is to say, whilst still hot, rubbed over with fat from a healthy beast. Their ribs were "skinned," so that the adhesions to the membrane lining the chest might be removed. Even the diseased lungs found their way to the sausage-machine; and it cannot be wondered at, if the editor of the *Times*, receiving a letter from me with these revelations, returned it with compliments, stating that it was all too horrible to be revealed in the columns of his paper. We have grown less squeamish of late years. Even Parliament has tacitly sanctioned the sale of carcases of diseased animals, under the "Contagious Diseases (Animals) Act." This is in accordance with an opinion expressed by the veterinary advisers of the Government. When asked whether the lung disease should be "stamped out" like the plague, the reply given by Professor Simonds was, "Not only is the flesh of animals affected with pleuro-pneumonia, in its early stages, a safe article of food, but there is little or no risk of spreading the disease by allowing the flesh to be sent to the meat market.

The offal also, excepting certain parts, does not need to be destroyed; on the contrary, every part of the body, and also all excremental matters, are thoroughly impregnated with the germs of disease in a cattle-plague animal. A salvage is, or has to be made in the one case, and not in the other; and this necessarily interferes with the adoption of the stamping-out process."

A few years more will reveal to all the folly of continuing, even under an Act of Parliament, to eat the carcases of sick animals. Why is the cattle plague no more? Because it killed so quickly that we were compelled to bury hides and all —there was no salvage. The country took fright, stamped out the disease, and cut short losses which might have led to the annihilation of our stock, but which constitute now but a very small amount compared to the losses by the lung disease. I must repeat with emphasis, that it would have been more to the interest of meat consumers and farmers had there not been the "salvage" in the shape of marketable carcases of animals stricken with the lung plague; and the sooner we compel them all to be buried, under the most stringent regulations, the better. We should then cease to hear reports, such as the one published for November, 1869, which tells us that "pleuro-pneumonia exists in forty counties of England, Scotland, and Wales; and as many as 165 fresh outbreaks have been reported as occurring in one week in November."

For many years no statistics were published which would open the eyes of Government to the fearful ravages of the lung plague.

Live-stock insurance companies, unknown prior to free trade in stock, were started so soon as the lung disease had sufficiently alarmed our farmers, and the causes of their ruin is easily ascertained from their books, the valuable records in many of which I first sought in 1861 and 1862. Amongst a mass of information, I learned that for the six years ending 1860, the average annual loss of cattle was 4·915 per cent., or amounted to 375,850 head over the three kingdoms. The estimated total loss for the six years was no less than 2,255,100 animals. The value of animals lost amounted to a grand total of £25,934,650, and of this more than one half was due to pleuro-pneumonia. During the six years we lost twice as many animals by lung disease as the total importations of horned stock from abroad; and in estimating values, it was found that the cattle lost were worth 5·89 times the value of those imported, and more than half this loss was due to pleuro-pneumonia. At a later period I confirmed my original inquiries by comparing the losses incurred by the three largest insurance companies; and demonstrated that whereas, prior to 1842, our losses could not be estimated at more than 1½ to 2½ per cent., the importation of foreign cattle and pleuro-pneumonia, involved us in losses varying, in different parts of the country, from 5 to 7 per cent. per annum.

In 1863 and 1864 my efforts were directed to securing legislation for the prevention especially of the lung plague and foot and mouth disease. I was not successful, and 1865 brought us the cattle plague, which we were ultimately compelled to exterminate; and, in the process, nearly exterminated pleuro-pneumonia. Ireland remained contaminated with this disease; and no sooner was the traffic in cattle reopened in Great Britain, than we had an increase in the number of its outbreaks, and that increase has gone on steadily up to the present moment.

We need look no further for the cause of much destitution and starvation in this country. We cannot lose the valuable animal produce of the land by millions of sterling's worth, without driving the poor to other countries. Emigration cannot be viewed as a calamity, but we have no right to starve out our skilful mechanics and industrious labourers that have cost the nation a large sum of money. When we consider that the remedy is in our hands, if we only follow the dictates of science and practical experience, it is tantalizing to watch the animal waste—a waste of the best blood and power in the world.

Our remedy lies in slaughtering all foreign stock at our ports, and extirpating contagious diseases from our farms. We must make up for past waste by importing preserved foods from every available point, and in this direction a great deal will be achieved soon. The beef and mutton of the Russian Steppes, of the South American Pampas, of our Cape farms and Australian runs, must repair the injury inflicted on us by thirty years' disease amongst British livestock. Many may emigrate, but millions remain to be fed; and it is our duty to see that they are fed abundantly with the wholesome produce of fertile pastures, and not with the diseased animals which folly and ignorance have compelled us to swallow since 1842. —*The Food Journal.*

TWO CURIOUS NEEDLES.

THE King of Prussia recently visited a needle-manufactory in his kingdom in order to see what machinery combined with the human hand could produce. He was shown a number of superfine needles, thousands of which together did not weigh half an ounce, and marvelled how such minute articles could be pierced with an eye. But he was to see that in this respect even something still finer and more perfect could be created. The borer—that is the workman whose business it is to bore the eyes in these needles—asked for a hair from the monarch's head. It was readily given, and with a smile. He placed it at once under the boring machine, made a hole in it with the greatest care, furnished it with a thread, and then handed the singular needle to the astonished King.

The second curious needle is in the possession of Queen Victoria. It was made at the celebrated needle-manufactory at Redditch, and represents the column Trajan in miniature. This well-known Roman column is adorned with numerous scenes in sculpture, which immortalize Trajan's heroic actions in war. On this diminutive needle scenes in the life of Queen Victoria are represented in relief, but so finely cut and so small that it requires a magnifying glass to see them. The Victoria needle, moreover, can be opened. It contains a number of needles of smaller size, which are equally adorned with scenes in relief.—*Scientific American.*

The Cobra Question in India.—The experiments which have been started in India to ascertain the value of reputed antidotes to the poison of venomous snakes, and with a view to the discovery of new cures for snake bites, still continue. Dr. Shortt informs us that in every district which he visits in the Madras Presidency, during his tours as inspector of vaccination, he affords the residents every opportunity of testing for themselves any reputed specifics that they may possess, so as to thoroughly satisfy themselves as to the inutility of trusting to such things as pieces of wood and stone, roots, and the like —a great point, when gained, of course. As yet, Dr. Shortt has found nothing of any real use in checking the, at present, certain fatal effects of the cobra bite. Believing that, owing to the energy and rapidity with which the venom acts, even if an antidote be discovered, few persons could benefit by it, Dr. Shortt has recently been advocating the provision of a fund, from which to pay so much per head for the destruction of poisonous snakes. As an experiment, he sent fifty rupees to the Commissioner of Police at Madras for that purpose. It was notified by the tom-tom that so much would be paid for small and so much for large snakes, of a venomous kind, brought to the police-office; and from March to October the result was as follows: 117 cobras, and 25 chain vipers—in all 142. The precaution is taken to have the heads of these reptiles removed before burial, so that no deception can be practised in respect to the number actually killed. We regard Dr. Shortt's suggestion as good, and deserving of support.—*Lancet.*

Japan Chestnut-Trees.—A shipment of 5,000 of these valuable trees was received at this port a short time since, which are selling at 25 dols. per hundred. This is the second large shipment of these useful trees. California will soon be stocked with the finest chestnut-trees in the world.—*San Francisco Mining Press.*

THE BUNCH GRASS OF BRITISH COLUMBIA (*ELYMUS CONDENSATUS*, FRESL.).

SOME time since we pointed out the difference between this and several other grasses of Western North America, to which the name of Bunch Grass has been applied, accompanied with quotations, descriptive of its appearance and feeding qualities, from the writings of several who were thoroughly acquainted with its native growth and usefulness; prominent among whom was Colonel Moodie, R.E., who introduced the Tussac Grass from the Falkland Islands, and by whose assistance our much-valued correspondent, Mr. Robert Brown, who was then collector for the British Columbian Botanical Association of Edinburgh, was enabled, in 1863, to send home a supply of its seeds, and thus first introduced it to Britain. To most of the members of this association grass seeds, however, presented little or no attraction; and, with the exception of what fell to the shares of the Edinburgh Royal Botanic Gardens and I. Alderson Henry, Esq., of Woodend, together with a few plants in our own collection, the Bunch Grass of British Columbia was so utterly neglected that it might have been lost to the country, notwithstanding that its merits, both as an early forage and an abundantly productive hay grass, are likely yet to secure for it a highly prominent place among the cultivated agricultural plants of Britain. With us the *Elymus condensatus* has gone on increasing annually in stature; and although grown in the past dry summer on rather poor unmanured soil, a plant, which is represented by the accompanying engraving (p. 196) from a photograph, was 8 ft. 3 in. in height. Of this, several seed-bearing as well as leafy stems were exhibited in the collection of Mr. R. T. Mackintosh, at the last July Show of the Highland and Agricultural Society of Scotland; and others were shown by its introducer, Mr. Robert Brown, at the meeting of the Largo Field Naturalists' Society, which was held last August at Elie, in Fife. This plant presented a thick, tender, leafy growth, of about 3 ft. in height in the last week of April, when it decidedly surpassed, in bulk of crop, the grass then growing in the neighbouring famed sewage-irrigated meadows of Edinburgh. So that, as a highly productive, early cutting grass, it ranks far before any other known kind. A plentiful crop of ripe seeds was reaped from the fertile stems in the first week of September, by which time several of a thick intermingled growth of leafy or barren stems (see fig. 1, p. 196) had attained to about the same height as the seed-bearing ones, while the others of these were of various intermediate heights. All the stems, as well as foliage, changed from a greenish to a brown withered-like colour by the second week of November.

The following analyses of both the seed-bearing and leafy stems have been made by Professor Anderson, analytical chemist for the Highland and Agricultural Society of Scotland, who stated in an accompanying note:—

"I inclose analyses of the two samples of Bunch Grass. They have not so high a nutritive value as good ordinary hay, which contains twice as much nitrogenous matter, and rather more oil.

	Leaf-bearing stalks.	Seed-bearing stalks.
Water	14·84	18·29
Oil	1·71	1·36
Albuminous compounds	4·44	3·62
Mucilage, gum, &c.	48·21	41·93
Fibre	26·61	30·65
Ash	4·19	4·15
	100·00	100·00
Nitrogen	·71	·58
The ash contains—		
Phosphates	·39	·15
Phosphoric acid combined with alkalis	·21	·19
Sand	2·15	1·95

I am, yours truly, THOMAS ANDERSON."

Although the above analyses do not show so high a nutritive value as that of good ordinary hay, this must not be deemed deprecatory of this Bunch Grass, seeing that both samples were cut in October, fully a month after the seeds were ripened; whereas grasses generally contain most nutriment when cut immediately after flowering.

In cultivating the British Columbian Bunch Grass, we would recommend sowing it in drills or beds, allowing it to grow there for at least one season, and then transplanting it in well-cleaned and drained land, at distances of 12 to 15 inches apart. The seedlings make but little growth, and never run to seed in the first season. Hoeing or weeding will therefore be requisite throughout the first summer and autumn after transplantation; but afterwards the plants will be sufficiently strong to overpower most kinds of weeds. And they will seemingly grow on in full vigour for a long series of years.

Subsequent to our fore-mentioned notice of this Bunch Grass, we have received the following particulars regarding it in its native habitats. In a paper on the Flora of Alaska—formerly known as Russian-America—which appeared in the *Smithsonian Report* for 1867, the writer, Dr. Rothrock, states that the high grounds in the vicinity of Fort St. James (lat. 54° 1′ N.) afford the Bunch Grass (Elymus) of the packers. So nutritious is this, that, even when apparently dead and dry, stock will become fat on it, and remain so under hard work for long periods, if this be plentifully supplied. In a recent Californian newspaper, a correspondent mentions that in the vicinity of the Boise Basin, in Idaho Territory, "the Blue-top Bunch Grass" covers the hills, and is as good as hay, some even considering it as approaching, in its nutritive qualities, to grain. There may, however, be some doubts whether one of the other Bunch Grasses formerly referred to, and not the *Elymus condensatus*, may be that here noticed. But the most recent reliable and important information regarding it is contained in the following letter to Mr. Robert Brown, of the British Columbian Botanical Expedition, from a friend who lived for several years in the Bunch Grass country:—

"Lyneal, Ellesmere, 9th Sept., 1869.

"DEAR SIR,—You ask my opinion of the Bunch Grass of the central plateau or table-lands of British Columbia—*Elymus condensatus*, as I believe you botanists call it. After a five years' experience of that country, I can bear testimony to the nutritious and fattening properties of this grass, far surpassing, I believe, those of any other known herb. A few facts will abundantly illustrate this.

"In the early years of the colony, before oats or barley had been imported, this Bunch Grass was the only (as it is still the principal) food of the trains of mules and horses which, heavily laden with provisions and goods, followed the gold-diggers into the mines, over the roughest possible trails. I have ridden hundreds of miles on horses whose sole support was this Bunch Grass. Turned loose at sunset, when the camping-ground was reached, to feed, they were found next morning as fresh and gay as ever. Indeed, on such a journey, if not ridden too hard, they would rather gain flesh than lose it.

"In my *Essay on British Columbia*, page 40, I have spoken of the marvellous increase of stock in that part of the country, an increase, owing, I believe, mainly to the amount of vital energy imparted by this herb.

"Then, as you are aware, the droves of cattle which supplied beef to the mines of Cariboo, had been driven 600 miles from Oregon, yet they were in excellent condition on their arrival, owing to the excellent pasturage, which refreshed them each night after the journey of the day.

"Finally, both horses and cattle used to survive winters of great severity; so long as there was not too much snow for them to paw aside, they could subsist on what tufts of Bunch Grass they could reach. It must have been hard times for them, but they managed to survive.

"I am rejoiced to hear that the experiment of trying this grass near Edinburgh has succeeded so admirably; and I trust agriculturists may be induced to try it on a larger scale, as I am convinced farmers and cattle-breeders would soon learn to appreciate its muscle-making and fattening properties.—Believe me, dear Sir, yours very faithfully, "R. C. LUNDIN BROWN, Vicar of Lyneal, Salop."

A very distinct variety has been raised in the Edinburgh Royal Botanic Gardens, which may be named *Elymus condensatus compactus*, from its spikes or ears being much shorter and broader than those of the original form; bearing, in fact, the same relation to the latter that the ears of the *Triticum compactum*, or Ducks-bill wheat, does to those of the common beardless wheats.—*The Farmer*,

The Bunch Grass, Elymus condensatus (showing habit of growth).

Fig. 1.—*Leafy or barren Stem. Spike—Natural size.*

Spikelet, magnified.

Seed, natural size.

THE MAMMOTH CAVE AND ITS WONDERS.

THE Mammoth Cave is always an object of great curiosity with the Americans. They go there in crowds, and there is not always accommodation to be found in the great hotel intended to receive the tourists, although it is arranged for 300 guests. The exploration requires five or six days, and an army of guides is always kept ready for the service of travellers.

Each site in this celebrated cave bears a picturesque name. There is the Starry Cavern, dazzling with stalactites; the Chamber of the Spirits, formerly encumbered with Indian mummies, which, by an act of profanation, has become a species of refreshment-room, where the wives of the guides supply liquors and newspapers to those travellers who are already fatigued

FIG. 1.—*Cyprinodons of the Mammoth Cave, U.S.*

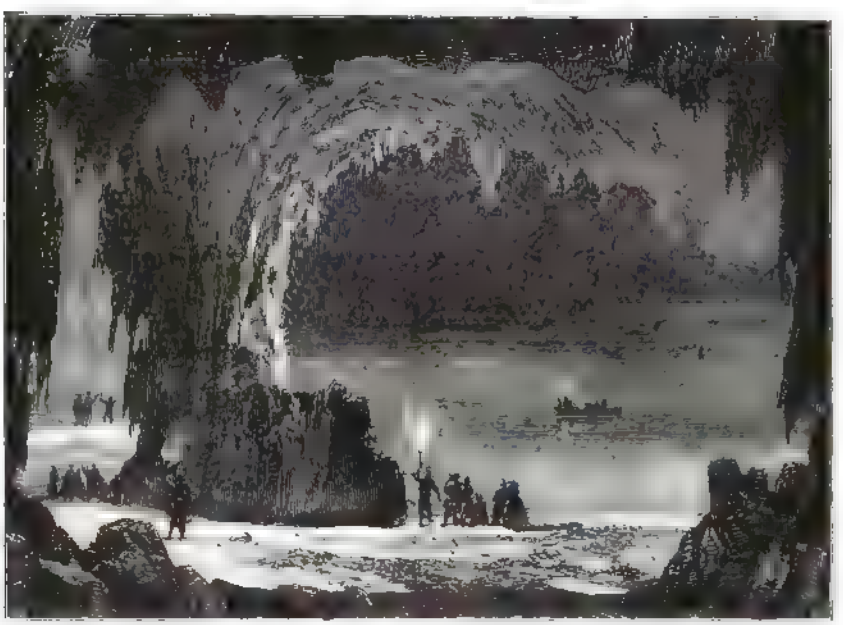

FIG. 2.—*The Dead Sea in the Mammoth Cave.*

with the subterranean journey, and are glad to make a short halt.

There is also a kind of hospital here, where some medical man keep patients afflicted with chest affections, thinking that the sulphureous atmosphere of these caverns would be favourable to them.

In the centre of this hall an almost entire skeleton of a mastodon has been set up. It is also at this part of the Mammoth Cave that the wives of the guides show and sell, to those who care for such things, the extraordinary little blind fish, the Cyprinodons (fig. 1), which are caught in the water-courses of these immense caverns.

Further on is seen the Devil's Arm-chair, which, like a gigantic crystallization, rears itself all gleaming on the brink of a dark bottomless abyss. Besides the Styx and the Dead Sea (fig. 2), these caverns, in which underground windings 20 to 25 miles in length are known, possess other bodies of water. Up to the present time 226 avenues have been made out, besides 57 domes, 11 lakes, 7 rivers, 8 cataracts, and 32 abysses, some of which are of immense depth.—*The Universe.*

REVIEWS OF BOOKS.

Memoirs of the Anthropological Society of London, 1867-8-9. Vol. III. London: Longmans. 1870.

THE Anthropological Society of London was, in its earlier years, a very flourishing incorporation. It was numerically a success; it raised up a great many antagonists—no bad sign of its merits,—and it published some interesting contributions to our knowledge of the natural history of man. But for a considerable period of time its existence has been spent in the *otium*, if not the dignity, of partial insolvency; hence its opportunities for encouraging the science of Anthropology have been meagre; and many of its enemies began to suspect—nay, even to hope—that it was like a house built upon the sand, which the storms of pecuniary difficulty would soon sweep away. Happily, the Society has travelled through its trouble, and a brighter future is in store for it. In the very excellent volume of memoirs now before us, and for which we have waited so long, we have at once a guarantee of the Society's strength and energy, and a promise of its ultimate success: and we are glad that it is so.

Here we find nearly seven hundred pages of well printed and illustrated matter, of unequal quality of course, but all of interest to those students who devote themselves to the solution of the complex problems connected with the evolution of man from the savage to the sage. Many of the papers in this volume are of sterling value, if merely as careful records of facts difficult to collect and arrive at. Some are very little better than weak *réchauffées*. Others again, though containing no material that can strictly be styled original, are nevertheless of importance, from the circumstance that they suggest new modes of grouping phenomena, and therefore new generalizations. There are in all nearly thirty memoirs, and these cover a very large anthropological field, and deal with a multiplicity and great variety of questions anent man. We cannot stay to notice these communications in detail, but we should be dealing unjustly with the volume did we not refer to a few of them which appear to us of special import as contributions to Science. Such it seems to us are the papers by Sir Duncan Gibb on "Vocal and other Influences on Mankind of Pendency of the Epiglottis," by Mr. Bollaert on "The Ancient Pottery of the Shores of Ecuador," and, lastly, by the esteemed President of the Society, Dr. Beddoe, "On the Stature and Bulk of Man in the British Isles." The last named article is one which, even if it be dissociated from the author's conclusions, contains a vast array of apparently well-authenticated statements concerning the *physique* of the natives of Great Britain and Ireland. It is composed of records of careful measurements and weights of Britons in different classes of life in all parts of the kingdom, and extends over scarcely less than 200 pages of the present volume. We are disposed to look upon some of Dr. Beddoe's generalizations as a little premature, even from so considerable a quantity of data as he adduces; but we do not on that account reject them; and they are expressed with so full and candid an acknowledgment on the part of the author of the many difficulties opposed to them, that we must congratulate Dr. Beddoe on the tone of his philosophy. In the appendix to this paper we find a better sketch of Irish ethnology than Englishmen are wont to give, but we fancy—we trust we are mistaken—that Dr. Beddoe refers to the Danaans as though they were of the Danish stock. This, if so, is an egregious error; for in all probability the "Tuatha Danaans" were a group nearly equivalent to the ancient Britons. We would also dissent from Dr. Beddoe's division of the British Kelts, and his arguments against Broca's views; but we are free to confess that decided opinions on either of these points are to our minds luxuries of the future. Uncertain and imperfect statistics are all we can boast of in the present. We promise those who take up this volume that they will find it interesting and instructive, with some pages worthier of even a better fate, and with some also like the *Saturday Review's* pliant husbands, "just worth their keep."

Narrative of the Voyage of the Floating-Dock "Bermuda" from England to Bermuda. By One of Those on Board. London: J. B. Day.

WHEN first Englishmen heard that it was intended to build a huge iron dock at home, and then to convey it across the Atlantic to Bermuda, they simply smiled incredulously at the idea of what appeared to them so futile an enterprise. Nevertheless, the idea is now *un fait accompli*; the huge structure was hammered together in England, and was successfully towed out to the West Indies, where it will for centuries remain as a monument to British enterprise, patience, and manufacturing skill. "But," some of our readers may ask, "what is the nature of the construction of the Bermuda Dock, how is it intended to be employed, what amount and variety of work is it capable of doing, and, lastly, how was it got across the Atlantic? where, as Ingoldsby says:—

> "The wind blew as rude as
> Shakespeare describes by the still vext Bermudas."

To all such we may answer that a "full, true, and particular" account will be found in the capital narrative which Mr. Day has published and so aptly illustrated. In the pages of this work we are treated to a pleasant sketch of the various naval evolutions necessary to the convoy of so extraordinary a floating mass as the dock is, and to the other remarkable incidents of the voyage. The most interesting part of the book, however, is not the account of the voyage, but the description of the dock itself, and the uses to which it is adapted. These are very fully stated in the text. But even without reading one may learn all the purposes of this vast structure by glancing at some of Mr. Day's excellent chromo-lithographs interspersed between the pages. In these "he who runs may read," or, rather, he may see pictorially the Bermuda Dock submerged to allow a huge vessel to float within its walls, or elevated so as to lift the ship, so to speak, on dry land, so that every part of her may be submitted to examination and repair, or finally heeled over for the purpose of careening. Much as we had heard and read of the Bermuda Dock, we must admit that we did not fully comprehend its great usefulness till Mr. Day's work fell into our hands.

Preliminary Field Report of the United States Geological Survey of Colorado, New Mexico. By F. V. Hayden, United States Geologist. Washington: Government Printing Office. 1869.

THIS work, which is a sample of how good work is done by the scientific men who are engaged by the American Government, we hope to notice at length in a future number, as its details are extremely numerous, and, so far as we can see at present, important. Meanwhile, we think it a report which those who "go in" for mining speculation—those, in fact, who would be what, in the parlance of the profession, are called "adventurers,"—would do well to read, mark, learn, and inwardly digest. It is authoritative, and we may add—not an invariable quality of mineralogical reports—honest also.

Transactions of the Highland and Agricultural Society of Scotland. February, 1870. Edinburgh: Blackwood.

THE opinion expressed in a recent Note of the Week, to the effect that the Scotch agriculturists are, in point of scientific application to farming, ahead of their English brethren, is more than confirmed by the volume just issued. Much of the contents has a high theoretical and practical value. Such papers as those by Mr. J. B. Webster, on the Diseases

of Forest Trees; by Mr. Armatage, on Pleuro-pneumonia, and on the Propagation of New Varieties of Potatoes, deserve the attention of agriculturists of all classes. The volume loses much of its interest, however, owing to Dr. Anderson's illness, which has prevented the publication of the results of the field experiments lately undertaken by the Society.

Annales de l'Observatoire Physique Central de Russie. Publiées par H. WILD, Directeur de l'Observatoire. Année 1865. St. Petersbourg: Iacobson. 1869.

HERE is a huge 4to of meteorological records. It is a fine type of this class of work. Its tables are elaborately planned, and are very carefully—if we may judge from fractions—filled in. The results are distinctly printed in Russian and French, and are published, not only from the Central Observatory, but from all the other meteorological institutes in connection with it. It is a most laboriously prepared chronicle of the weather phenomena of a single year.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

VOLCANO-FISH.—*From* G. POULETT SCROPE, F.R.S.

SIR,—In the number of SCIENTIFIC OPINION of the 16th inst. I observe a notice under this heading, by the Rev. W. W. Spicer, M.A., in which the writer refers to the well-known statements of Humboldt as to the large quantities of a peculiar species of fish often ejected from Cotopaxi, as well as from other volcanos of the same range in South America, during their eruptions. And this phenomena is spoken of as something "strange" and "astounding"—the idea evidently being that the fish must have lived in the interior of the volcano, "in the line of fire, before its contents were discharged by the crater's mouth." This sensational view of a very simple fact is one only of several which, on the authority of "the great Prussian traveller," have been repeated by compilers of treatises on volcanic phenomena. The simple fact, I conceive, is that the fish in question lived in the open air in crater-lakes, such as are frequently found at the summit of trachytic volcanos—for the reason that the fine ash, which is usually the last product of their eruptions, and therefore forms the lining of their craters, is very retentive of moisture, and consequently occasions the production of lakes at the bottoms of these hollows. Of course in these lakes the same kind of fish will probably be found as, by Mr. Spicer's own statement, are met with in other lakes at an almost equal elevation on the outer sides of these very volcanos.

Of course, too, when after a long interval of quiescence, a fresh eruption breaks out from a mountain in this condition, the waters of its crater-lake are discharged, and with its contents, fish, algæ, confervæ, &c., rush in torrents of mud (called Moya in the language of the country) down the outer slopes of the mountain. There is, therefore, no occasion for the "difficulty" which Mr. Spicer finds in endeavouring to account for the phenomenon in question.

G. POULETT SCROPE.

THE METEOROLOGICAL FEATURES OF THE YEAR 1869.—*From* F. B. FALKNER.

SIR,—I beg to subjoin a table giving the most prominent meteorological features of the different months of last year, as deduced from observations conducted by myself in this Midland region. The barometer is 335 ft. above sea-level. The circumstances of atmospheric temperature and moisture refer to a stratum of air 4 ft. from the ground.

1869.	Highest temperature of the air.	Lowest temperature of the air.	Total range of temperature of the air.	Mean maximum temperature of the air.	Mean minimum temperature of the air.	Mean diurnal range of temperature of air.	Mean temperature of the air.	Mean temperature of the dewpoint.	Mean humidity of the air.	Mean weight of water in a cubic foot of air.	Mean height of the barometer.	Highest observed reading of barometer.	Lowest observed reading of barometer.	Observed range of the barometer.	Rainfall.	General direction of lower current of air.
	°	°	°	°	°	°	°	°	°	grains.	inches.	inches.	inches.	inches.	inches.	
January.....	53·6	22·9	30·7	...	...	...	...	...	...	...	...	...	...	...	2·64	S.W.
February ...	56·6	29·5	27·1	49·7	36·0	13·7	44·9	41·0	·86	2·9	29·605	30·030	28·630	1·400	2·49	S.W.
March	50·4	25·0	25·4	43·8	31·4	12·4	37·5	34·2	·88	2·3	29·539	30·000	28·830	1·170	1·89	N. and N.E.
April	74·5	32·0	42·5	58·4	40·4	18·0	49·9	42·9	·79	3·2	29·693	30·110	28·880	1·230	2·21	Variable.
May	66·2	31·1	35·1	56·9	41·2	15·7	48·3	42·8	·82	3·1	29·544	29·980	28·830	1·150	4·88	N.E.
June	82·8	37·4	45·4	65·1	44·8	20·3	54·1	46·7	·76	3·6	29·789	30·050	29·230	0·820	1·20	N.W.
July	86·4	39·8	46·6	...	...	...	...	...	...	...	...	30·200	29·510	0·690	0·71	S.W.
August	80·5	31·8	48·7	68·2	49·2	19·0	59·6	52·6	·78	4·5	29·840	30·090	29·310	0·780	2·30	N.W.
September...	74·5	35·1	39·4	64·8	48·8	16·0	58·2	51·0	·77	4·2	29·458	30·130	28·770	1·360	3·65	S.W.
October.....	68·0	26·1	41·9	54·9	41·6	13·3	49·2	43·7	·82	3·2	29·720	30·160	29·040	1·120	1·23	N.W.
November...	58·3	23·6	34·7	47·6	35·1	12·5	41·8	38·3	·88	2·7	29·602	30·110	28·980	1·130	2·12	S.W.
December...	53·9	9·4	44·5	41·1	29·8	11·3	35·6	33·0	·91	2·2	29·456	30·260	28·520	1·740	3·42	W and variable.

For the year 1869, the highest temperature of the air occurred in July, and was 86·4°; while the lowest occurred in December (9·4°). The total range of the temperature of the air was therefore 77°.

The extreme readings of the barometer, so far as they were observed, were 30·26 in. in December, and 28·52 in. in the same month; the range of the barometer was, consequently, 1·74 in.

The rainfall for the year was 28·74 in., or more than 4 in. *above* the average. Winds from N.W. and S.W. were very much in excess of those from the Easterly quarters.

I remain, Sir, your obedient servant,

F. B. FALKNER.

Appleby Grammar School, Leicestershire, Feb. 18.

THE PROGRESS OF MICHIGAN GEOLOGY.—*From* ALEX. WINCHELL, LL.D.

SIR,—I forward a brief statement of what is going forward under my direction.

In February, 1869, the Legislature of Michigan passed an Act establishing a geological survey of the State, and appropriating the sum of $8,000 annually for its maintenance. On the 1st day of May I was commissioned by the Governor as "Director" of this survey. The law directs that one-half of the appropriation shall be expended in the *northern* peninsula of the State and one-half in the *southern*. These two peninsulas are as completely isolated by their physical features and surroundings as if they were two distinct States; and there is nothing in common in their geology. Save the superficial deposits, there is not a "formation" existing at the same time in the two peninsulas. The northern is eminently a metalliferous district highly disturbed and intricate in its geology; the lower, or southern, is a broad basin of Devonian and Carboniferous strata, which have never been dislocated to any extent by geologic forces. It contains coal, gypsum, and salt in great abundance; while the northern peninsula is one of the most celebrated regions in the world for the production of iron and copper (native).

Accordingly, while I occupy myself in the *general supervision*, and in *palæontology* and *physiography*, I have selected a competent assistant to take charge of investigations in the upper peninsula. For the present, the work there is restricted to the *iron region*, and is under the special direction of Major T. B. Brooks, with a corps of sub-assistants. This year another assistant will be appointed, whose duty it will be to complete a survey of the copper region. It is intended to have two or more volumes ready for publication at the next session of our Legislature, January 1, 1871.

Recent geological investigations in the west, and especially in Michigan, have demonstrated that we have at the very bottom of this Carboniferous system, a group of rocks hitherto unrecognized as distinct. It is the *Marshall group*. The older geologists confounded these strata with the *Chemung* of the New York geologists. The Waverly series of this is made up partly of the Marshall group, and partly of the *Chemung*. The rocks of the two groups are quite similar, and nothing but critical palæontological investigations could certainly distinguish them. Dr. Newberry, of the Ohio Survey, however, has succeeded in tracing the equivalents of the Marshall rocks eastward into the middle of Pennsylvania, where they had been denominated by H. D. Rogers the "Vespertine Series." There are reasons for believing that the "Ponent Series" of Rogers (Cattskill group of New York) will be found embraced within the Marshall group; if, indeed

this "Ponent" be anything more than a local occurrence of the "Vespertine."

I had myself recognized strata in north-western Pennsylvania of the age of the Marshall group, and decisively distinct from the underlying Chemung, as long ago as February, 1869. This determination was based solely on palæontological evidence. I have been urging the palæontological evidences of a distinction of age between the Marshall strata and the Chemung for six or eight years past. My papers are contained in *Sullivan's Journal*, the *Proc. Acad. Nat. Sci.*, Philadelphia, and the *Proc. American Philosophical Soc.*, Philadelphia. Similar views have been entertained by other western geologists, especially F. B. Meek, A. H. Worthen, and Dr. J. S. Newberry, though the latter had written nothing on the subject. They have, however, been opposed by Professor James Hall, at times with more earnestness than courtesy.

Another result of recent studies in western geology has been the addition of the Lower Helderbrig Group to the catalogue of formations of Ohio and Michigan. Heretofore it has been confounded with the Corniferous limestone, which is a very conspicuous formation in the west. These two, Lower Helderbrig and Corniferous, together with the Niagara limestone below, and the Hamilton limestone above, generally constitute, in the West, one physical mass, and were long known as the "Cliff limestone."

I send you by mail a printed copy of an outline of my proposed final report, which you will see is unusually comprehensive.

I will also send you from time to time other publications and announcements suited to keep you posted in the progress of our survey.

Very respectfully yours,

ALEX. WINCHELL, LL.D., Director Mich. Geol. Survey.

EUNUCHS AMONG ANIMALS.

SIR,—A gentleman of respectability resident near Fermoy, in Ireland, told a relative of mine lately that a few years ago he heard one night a great noise under his window, as of animals fighting. He looked out, the night being bright moonlight, and saw a badger and fox struggling together, the fox being undermost. Seizing a fishing gaff which was at hand he ran out and speared the badger. In the morning the fox was found hard by, dead and castrated, having apparently died of hæmorrhage. A SUBSCRIBER.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, FEBRUARY 17TH.—The following papers were read:—"On a Distinct Form of Transient Hemiopsia," by Hubert Airy, M.A., M.D.—From a comparison of the different accounts of "Hemiopsia," "Half-vision," or "Half-blindness," given by Dr. Wollaston (*Phil. Trans.* 1824, i. p. 222), M. Arago (*Annales de Chimie et de Physique*, tom. xxvii. p. 102), Sir David Brewster (*Phil. Mag.* 1865, vol. i. p. 503, and *Transactions of the Royal Society of Edinburgh*, vol. xxiv. part 1), the Astronomer Royal (*Phil. Mag.* July, 1865, vol, ii. p. 19), Professor Dufour (in a letter to the Astronomer Royal), Sir John Herschel (*Familiar Lectures on Scientific Subjects*, p. 406, Lecture IX., and private letters), Sir Charles Wheatstone (in a private letter), Mr. Tyrrell (*On the Diseases of the Eye*, 1840, vol. ii. p. 231), and the author of this paper, it is plain that there are different forms of transient Hemiopsia, irrespective of the wide primary distinction between the transient and permanent forms, which have all been included under the same name Hemiopia or Hemiopsia.

It seems that Wollaston, Arago, Brewster, and Tyrrell are describing one form of the transient affection, while Sir John Herschel, Sir Charles Wheatstone, the Astronomer Royal, Professor Dufour, and the author agree in describing another.

In the experience of the former group, the limits of the blind region, as projected on the field of view, are ill-defined, there is no variety of colour, and the progress of the disease presents no remarkable features.

In the latter group, the blind region is at first very small, and gradually spreads outwards, to left or right, with a zigzag margin of bright and dark lines, tinged in most cases with various colours,—clear vision gradually returning in the centre and following the outward advance of the curved cloud; usually the blindness occupies only one lateral half of the field of view; but in one very remarkable instance recorded by Sir John Herschel, the course of the cloud was from the extreme left to the extreme right, sweeping over the whole of the visual area.

Possibly the gap between these two forms may be filled by connecting links as further evidence arises, and it may be found that they differ only in degree of prominence of different features. The remarkable account given by Sir Charles Wheatstone (who has kindly given permission for its publication), where the zigzag luminous lines are strongly marked, but without colour, perhaps offers the first link in the connecting chain.

The author's experience dates from 1854. Since then he has repeatedly suffered from these attacks. The circumstances and features of the complaint have varied somewhat in different attacks, but the type has remained unaltered from that time to this.

The blindness comes on usually while the eyes are engaged in toilsome reading—some word or letter on the page near the sight-point (generally below to the left) is found to be obliterated; this germ of blindness slowly spreads, with zigzag margin, defined by alternate bright and dark lines, with gleams of colour, the margin rapidly trembling and slowly rolling at the same time.

These three orders of motion, (1) gradual outward growth of the whole, (2) slow rolling of parts, (3) rapid tremor of the margin, are especially characteristic of this affection.

The region of blindness takes a horseshoe shape; the upper arm points to the centre of sight, while the lower spreads downwards and outwards away from the centre. The zigzag pattern is minute near the centre, and grows larger the further it recedes. The gleams of colour, most conspicuous at the margin, are red and blue, yellow, green, orange, in order of frequency. As the blindness spreads outwards, clear vision returns gradually in the concavity of the horseshoe. The sight of both eyes is affected at once, exactly in the same manner and in the same degree; though naturally that eye *seems* most affected which corresponds to the obliterated side of the field of view, because the nasal half of the field of view of either eye is more limited, and vision there is less distinct than on the temporal side.

Looking at any surface of uniform colour, the cloud partakes of the general hue of the field on which it lies, and shows little that is characteristic except its bright margin, tremor, and boiling.

Against bright light, a faint, shadowy curved cloud is seen, with bright margin, tremor and boiling, and slight colour.

Against dark shade, the cloud is seen to show faint light.

When part of the cloud is seen against dark shade, and part against bright light, the boundary between the light and shade is wholly obliterated.

Viewed in the dark, the cloud presents inherent luminosity, especially at the margin. Its various colours are seen as well in dark as in light.

The cloud spreads outwards in horseshoe shape till it reaches the outskirts of the field of view, and fades away after great boiling and turbulence. The lower arm is the first to fade, then the middle, and finally the upper arm, which remains pointing to the centre of the field to the very last.

The climax is reached in about twenty-five minutes from the first beginning. The whole duration of the attack is just half an hour.

Often, midway in the attack, a fresh germ of blindness arises near the birthplace of the first; but always proves abortive unless it take root on the opposite side, when a second attack may develop itself immediately after the first.

This half-blindness is followed by oppressive headache, lasting many hours.

From the resemblance of the angular margin of the cloud to a fortified wall "with salient and re-entering angles, bastions and ravelins" (to use Sir John Herschel's words), the author ventures to suggest the name Teichopsia for this striking form of transient half-blindness.

Among the circumstances that have seemed to favour an attack may be mentioned sudden change of air and living, over-exercise, and insufficient sleep. The attack has sometimes been nocturnal.

The most usual position of the germ of blindness is 3° or 4° below, and 3° or 4° to the left of the centre of vision.

In one or two cases, after reaching a certain stage, the cloud has parted in the middle, and died away without ripening.

The cloud, whether developed in the right or the left half of the field has never (the author believes) transgressed the vertical median line.

Lately, one or two attacks have been followed by a slight disturbance of hearing.

Of three cases coming under the author's immediate observation,—in one, these attacks have been very frequent, from an early age to middle life. The bastioned outline is always present, with more or less colour. Formerly the attendant headache used to be very severe, accompanied with prolonged vomiting. Latterly the blindness has been more oppressive than the headache, and its advent greatly dreaded. The speech is often affected, and sometimes the memory, and on one occasion the mouth was noticed to be drawn to one side. The cause has seemed to be mental anxiety.

In the second case, which is adduced for the sake of contrast, the phenomena are much less definite. There is no serrated margin, no colour, no curve, nothing of which a picture can be made. The ob-

scurity grows from a small, but ill-defined germ, and gathers like a cloudy film or gauze over the field, oppressive to the eyes, and accompanied with headache and nausea, and passes away after a doubtful period, leaving the impression that it is caused by disorder of the stomach.

In the third case, the blindness is sometimes brought on by looking at a striped wall-paper, or a striped dress. The appearance before the eyes is described as zigzag, wavy, quivering, without colour. The first attack, in adult age, was followed by partial paralysis of one side, and later attacks have almost always had a sequel of defective speech, and tingling at the tip of the tongue, at the tip of the nose, and in the fingers and thumb.

At any rate it is certain that there does exist a distinct form of transient hemiopsia, presenting the following main characteristics:—

1. Dependence on mental anxiety, bodily exhaustion, overwork to the eyes, gastric derangement (?), want of exercise.
2. Origin from a small germ near the centre of vision.
3. Orderly centrifugal growth from the original germ.
4. Blindness to boundaries, but not to general impressions of light and colour.
5. Proper luminosity in the dark.
6. Bright-bastioned margin, with gleams of various colours.
7. Tremor and "boiling."
8. Gradual occupation of one lateral half of the field of view.
9. Gradual recovery of clear vision in rear of the outward-growing cloud.
10. Disappearance of the phenomenon after about half an hour.
14. Sequelæ: headache and nausea, and sometimes affection of speech and hearing, and even symptoms of hemiplegia.

As to the actual seat of the visual derangement, the exact agreement of the two eyes in the nature, extent, and degree of their affection, proves (assuming the semi-decussation of the optic nerves at the chiasma) that the seat of the affection must lie at some point behind the chiasma of these nerves. All the causes that are found to lead to transient half-blindness, point to the brain as the seat of disturbance. Still clearer is the evidence given by the loss of speech and of memory, the derangement of hearing, and the partial paralysis that sometimes follow an attack of teichopsia. Such cases as Sir John Herschel's, where the cloud passed over the whole field from left to right, can only be explained by supposing the disturbance to lie in some region of the brain where the opposite halves are in contact. The mischief may possibly be seated in the corpora quadrigemina or geniculata, or even in the cerebellum itself.

As to the nature of the mischief in the brain, it is difficult to do more than hazard guesses. Is it a temporary suspension of function among the nerve-cells of the visual sensorium, due to vascular congestion, and relieved by the relief of that congestion? Does the headache tell of the further propagation of the nervous disturbance into parts of the brain where disturbance is ache, as in the visual tract disturbance is abnormal sensation of light? And the detriment to speech and hearing—does it mean extension of the same disturbance still further into the regions of brain-substance appropriate to those functions? Or is the attack in any way analogous to a fit of epilepsy?

The phenomena are so definite and so localized, and their course is so regular, that we can hardly avoid the conviction that their cause is equally definite and equally localized; and it is difficult to admit so vague an agent as nervous sympathy with gastric derangement, except as acting through the medium of some secondary local manifestation in the brain.

"Account of the Great Melbourne Telescope from April, 1868, to its Commencement of Operations in Australia in 1869," by Albert Le Sueur.—A description of the great Melbourne reflector, and its history, up to the time of inspection by the committee have been communicated to the Royal Society; the following additional account of the doings connected therewith since the instrument was consigned to my care may be of interest to the society.

Mr. Grubb commenced taking down the telescope at the end of April, 1868; this was accomplished in no great length of time, and without any difficulty. The specula (by the advice of Mr. Lassell, who had found this method answer perfectly) were coated over with shellac varnish to prevent oxidation on the voyage out; they were then protected in their cells and on their lever supports by strong double wood casings, the other parts of the telescope and machinery cased or otherwise protected. The only casualty which there seemed to be any reason to fear could give rise to any serious consequences was a tilting over of the speculum cases; their great weight was, perhaps, a sufficient guarantee from such an event; it was nevertheless thought prudent that the telescope, and machinery generally, should not be left entirely to the tender mercies of the shipping and crane labourers; I was therefore present at the shipping in Dublin on board a steam-tug hired for the purpose, and at the transhipment in Liverpool on board the *Empress of the Seas*.

Both these operations were performed satisfactorily, and without any serious casualty.

The *Empress of the Seas* sailed from Liverpool on the 17th or 18th of July; I followed by the August overland mail.

On my arrival in Melbourne I found that, beyond a selection of a site in the Observatory grounds, nothing had yet been done towards the erection of piers or building; this was principally owing to the fact that Mr. Ellery and the Board of Visitors had not considered the information which they possessed sufficiently definite to warrant their placing the matter in the hands of the Works Department; it had therefore been thought advisable to await my arrival.

Some necessary modifications having been made in the drawings, the construction of the piers was soon proceeded with, and satisfactorily terminated at the beginning of the year.

In the mean time the *Empress of the Seas*, with her precious cargo, had arrived, after a very long voyage, which for some time was the cause of much uneasiness; parts of the instrument were unpacked and temporarily housed, the whole appeared in fair order; there was certainly no material damage done to anything.

Arrangements being in progress for the erection of a suitable building, it was thought advisable to delay mounting the telescope until part of the building was constructed; little therefore was done for some time beyond setting up, as accurately as possible, the plummer blocks which contain the Polar axis bearings.

The building was commenced early in the year, and when it was thought that sufficient progress had been made, the crane which had been used in the erection of the piers was removed to a more convenient position, and the various heavy parts of the instrument lifted on to the floor of the telescope-room, over the walls or through a gap left for that purpose, and for convenience in after operations in the north wall and north end of west wall.

The mounting was then proceeded with, and satisfactorily accomplished in little more than a week, as regards the main parts, without much difficulty.

Attempts were made on one or two occasions to use the instrument for adjustment and observation, but it was found that the dust (a dreadful enemy in the summer) and the grit caused by the building accumulated to such an extent as to lead to fear of considerable damage to the bearings and more delicate parts of the machinery; it was therefore deemed prudent to cover up the telescope as well as possible with tarpaulins, and leave it in *statu quo* for some time.

The building is rectangular, 80 ft. long meridionally by 25 ft. wide, with walls 11 ft. high. Of the meridional length the telescope-room occupies the north 40 ft.; the next 12 ft. are appropriated to the polishing-machine, crane, and engine; the remaining 28 ft. are divided into two rooms, one of which is at present used as an office, the other, 25 ft. by 14 ft., is intended for a laboratory. The movable roof is 40 ft. long, and runs on rails laid the whole length of the walls; the telescope-room may therefore be completely covered in, and as completely uncovered when required, the roof in the latter case resting on the south building, which on that account has a very low permanent roof.

The roof is constructed of six triangular wrought-iron principals, cross-braced, which abut at each side on a broad horizontal plate formed of two parallel lengths of stout angle-iron, connected at various points by iron bands; for additional strength, a broad vertical plate is bolted to the outer angle-iron piece. There are four pairs of wheels, 26 in. in diameter, flanched on the inside; these lie along the middle of the horizontal plate, the journals being bolted to the angle-iron pieces which form the plate.

The roof is covered with galvanized corrugated iron, and is therefore on the whole a somewhat heavy affair; the mechanical arrangements for moving are, however, simple and effective. A stout iron shaft runs across the building, and gears by wheel and pinion on the axles of the two south end wheels; to this shaft is fixed a spoked hand wheel, by means of which the operator readily sets the roof in motion, and standing on a small platform connected therewith, is himself carried along at the same time.

The design of the roof is due to Mr. Merrett, of the Works department. On the whole, there is much to be said in favour of this rectangular form of roof; the temperature even in this climate frequently descends too low to be pleasant, but the occasional bodily inconvenience produced thereby is more than counterbalanced by perfect freedom to the observer, and the gratification of knowing that the instrument is in the best possible conditions for satisfactory performance: only one really serious annoyance have I found connected with complete exposure—I allude to occasional heavy dew rendering it almost impracticable to use the sketching and other papers; the speculum meanwhile remaining free from deposit if precaution is taken not to work at too great an altitude.

The telescope, when housed, lies meridionally on the east side of the pier, and nearly in a horizontal direction, provision having been made to prevent the tube being lowered beyond a certain small inclination.

The piers are in keeping with the massiveness of the instrument; they are constructed of large, not to say huge blocks of basalt axed to a fine surface,—altogether a substantial and beautiful piece of work.

The height of the walls with reference to the piers is such that very little of the sky range is curtailed. The north wall cuts off objects having a lesser altitude than about 10°; when resting on the east or west walls the telescope is nearly horizontal; in both these directions trees interfere, especially on the west side, where the ground rises. This curtailment will probably be a matter of very small importance, as with a four-feet aperture observations at low altitudes are almost impracticable, and would probably never have to be resorted to except in the case of comets. The roof itself cuts off some of the range near the subpolar meridian; this, again, is not likely to be of much consequence.

The steam-engine, polishing-machine, and crane have been mounted in the room devoted to them; this room adjoins and is on the same floor (raised 4 ft. from the ground, and 3 to 6 ft. from the floor of the other rooms) as the telescope room. To the east end of this machine-room, and communicating therewith, a small lean-to boiler-house has been added; in the west wall is a window which, when open, will leave sufficient clear space to admit of viewing a distant nearly horizontal object for purpose of testing the mirrors.

The large speculum was originally attached to the tube in its varnished condition; on the first favourable occasion it was taken down and unvarnished—a process which proved more troublesome than had been anticipated; the lac was very refractory, and the difficulty of removal exaggerated by the extreme heat then prevalent; after a process of solution in alcohol, mopping up and washing with water frequently repeated, although there seemed no lac which would still dissolve, a large number of markings, caused originally by the varnish brush were apparent, and the whole surface had an unpleasant mealy appearance.

It was thought, however, that the light lost would not prove serious, and in any case it did not seem that any further operation except polishing would improve matters. The speculum was therefore remounted and tried; and although it was of course impossible to say what would have been the effect of a more perfect polish, the views given of the brighter nebulæ were grand in the extreme, and left nothing to be desired.

By degrees, however, and without much exposure, the surface became more and more tarnished, with evident effect on the performance.

In the mean time the second mirror had been unvarnished; in this case naphtha was used as the solvent, the solution mopped up, and the surface washed with soap and water; after a frequent repetition of this process, the surface seemed clear of impurities, and though not so bright as I had frequently seen it in Mr. Grubb's workshop, there were no signs of mealiness, the only unpleasant casualty being a considerable pitting of two patches some 2 in. square, produced by droppings from the muriate used in soldering the tin cover. These pittings are deep and unsightly, but the extent of surface corroded is comparatively so small that the effect must be inconsiderable.

The specula were exchanged about two months ago, but nothing has yet been done towards repolishing, as the necessary arrangements have not been got together for performing that delicate operation with due convenience.

Of work done I cannot yet speak with any satisfaction. Since it became at all practicable to use the telescope, the history which I have to relate is a long chapter of weary heart-breaking watchings, with an occasional half-hour's work.

η Argo was the first object observed for purpose of delineation; after the first night's work little (and that by snatches) was done towards it: a new inroad of workmen and a long course of extremely unfavourable weather having carried the nebula out of convenient reach. The search, which was reluctantly given up, will, however, be again soon resumed.

Of work out of the regular course, amongst other things, Neptune has been observed on some five or six occasions for figure and a second satellite, with only negative results.

In the absence of a photographic apparatus to be used at the uninterrupted focus of large mirror, attempts have been made to utilise the 2nd or Cassegrain image; an average exposure of near ten minutes on an eight-day moon produced pictures which (by no means good) were of sufficient promise to make it worth while to resume the attempt under more favourable conditions.

The time of exposure is somewhat surprising, and would seem to accuse a great loss of chemical rays by a second perpendicular reflexion; but perhaps the more legitimate conclusion would be that the inactivity was mainly due to absorption at the surface of the large mirror, which was then very yellow.

The spectroscope arrived some time ago, but has not been much used: it is thought that for *star* work of any value some modification will be required, principally the exchange of the present collimator for one of longer focal length; a greater dispersion, moreover, seems desirable; for nebular work, however, for which it was mainly designed, the spectroscope in its present form, which is handy and compact, will be of much service.

For spectroscopic work on objects having a sensible diameter, the great telescope itself labours under some disadvantages, the enormous focal length and consequent magnification of the image is a serious inconvenience in the case of faint objects, and may be only partially remedied by a suitable condenser. This magnifying of the image may, however, in some cases be advantageous—I allude to the possibility thereby afforded of viewing small definite portions of moderately bright objects; unfortunately the objects with which we have to deal are seldom of such a character.

Of nebulæ, Orion has been examined for purpose of practice; the three lines are plainly and conspicuously seen; the hydrogen line is comparatively much fainter than I had anticipated, and disappears in the fainter portions of the nebula. 30 Dorado shows the nitrogen line with facility, the second line certainly, but not in all positions, and always with difficulty; the hydrogen line is suspected only. I can see no trace of a continuous spectrum.

η Argo has been observed on only one unfavourable morning; the nitrogen line was seen over a considerable space; of the presence or absence of others, or of a continuous spectrum, I am unable to speak with certainty.

With respect to future operations, it is intended that at first the routine work shall consist of a detailed delineation of the objects figured by Sir John Herschel, or any others which may prove interesting; this will take some time; for even without the impediment of cloudy weather, the delineation with any degree of satisfactory correctness, of a moderately large nebula, requires a considerable amount of work and careful and frequent scrutiny. It is hoped, however, that this work will by practice be found less painfully difficult than it is at present.

The spectroscope will be used as much as possible, the moon photographed, and attempts made to photograph the nebulæ, when a photographic apparatus has been procured, and staging, photographic room, &c., added to the building. It is moreover hoped that before long a refractor, of some nine inches aperture, may be procured, to be mounted with the reflector, or, preferably, as a separate instrument.

This telescope, besides being of much general use, will find much and valuable employment in determining micrometrically the chief points in the nebulæ under examination with the reflector, with more expedition and accuracy than at present; for spectroscopic work this telescope would be a valuable adjunct, especially if it be constructed of such comparatively short focal length as seems now to be practicable.

The great interest which the Royal Society has taken in everything connected with the Melbourne reflector is my sole apology for sending thus early such a meagre account.

GEOLOGICAL SOCIETY OF LONDON.

FEBRUARY 9TH.—Professor Huxley, LL.D., F.R.S, president, in the chair. Alexander Murray, Esq., of the Geological Survey of Canada, St. John's, Newfoundland, and Frederick William Rudler, Esq., Museum, Jermyn-street, S.W., were elected fellows of the society.—The following communications were read:—"On the Fossil Corals (Madreporaria) of the Australian Tertiary Deposits," by P. Martin Duncan, M.B. Lond., F.R.S., Sec. Geol. Soc., Professor of Geology in King's College, London.—The author noticed the history of our knowledge of the South Australian Tertiary Deposits, and indicated the general distribution of the fossiliferous beds from which the corals forming the subject of his communication were derived. These were said to be confined to the region west of Cape Howe, prevailing especially in the province of Victoria, where they had been admirably surveyed by Mr. Selwyn and the officers under him, and to consist chiefly of limestones covered, and in some cases underlain, by great outflows of basalt. The author then gave a list and descriptions of the species (31 in number) of fossil Madreporaria obtained from these South-Australian Tertiary beds, followed by remarks on the characters and relations of the more remarkable forms, and on the localities where they have occurred. From his examination of these fossils, he objected to the application of the divisions adopted in European geology to the deposits in which they are found. He then compared the assemblage of corals obtained from the South-Australian Tertiaries with those found in various deposits elsewhere, or living in the existing seas. The species were stated not to belong to reef-building forms, but to such as now occupy the sea-bottom from low spring-tide mark to the depth where Polyzoa abound. Of these, twenty genera were said to be now represented in the Australian seas; but only three of them to have species in the Tertiaries, viz., the cosmopolite Trochocyathus, Flabellum, and Amphihelia. The fossil species of these were stated to be quite distinct from those now living in the neighbouring sea. Two species, viz., *Flabellum Condeanum* and *F. distinctum*, are living in the Chinese, Japanese, and Red Seas; the author's *Plecotrochus elongatus* is very nearly allied to the Chinese *P. Condeanus*; and a Deltocyathus is regarded by the author as only a varietal form of a living West Indian and European Miocene species (*D. italicus*). Three species are common to the Australian and European Cainozoic deposits. Several of the species were said to present curious anomalies of structure, such as so frequently appear in Australian forms, and those of the different beds to exhibit so close a general resemblance, that they

offer no evidence of great changes having taken place during the deposition of the whole series of sediments. The evidence afforded by the fossil corals led the author to conclude that, at the time of the formation of these deposits, the central area of Australia was occupied by sea, having open water to the north with reefs in the region of Java, and with openings into the Mediterranean and Sahara to the north-west; that Continental India did not form part of a great continent; that the greater part of America was submerged, and the Caribbean sea a coral-area; that the bulk of the land was situated in the north and south; and that the upheaval of Australia and New Zealand was approximately synchronous with that of the great mountain-chains of the Old World, with the closure of the Panama area and the depression of the areas on either side of the American continent.

Discussion.—The president inquired whether the absence of reef-corals might not be indicative of the climate of South Australia having been much the same as at present in Tertiary times, as these forms required a temperature of about 68°.

Professor Ramsay expressed his satisfaction at the manner in which Mr. Selwyn's work on the Australian Geological Survey had been appreciated by the author.

Mr. Jenkins, who had been working on the fossil mollusca of Australia, had arrived at the conclusion that at the time of the deposit of the beds mentioned by Dr. Duncan, the climate had been warmer than at present. The shells presented the same strange and abnormal features as the corals in differing from other older and well-known species merely in some minute detail. There was no point of contact between the Australian and European faunas to afford a criterion of relative age, though there were some points of similarity to be found in the Mediterranean area.

Mr. Gwyn Jeffreys stated, as an instance of the singularities of the Australian fauna, that *Rhynchonella psittacea*, essentially an Arctic species, had occurred in the tertiaries of Spain, in our Glacial deposits, and the Norwich Crag, and is now found living in Australia.

Dr. Duncan shortly replied to the various speakers, and was disinclined to limit the occurrence of any forms of coral to particular temperatures.

"Note on a new and undescribed Wealden Vertebra," by J. W. Hulke, F.R.S., F.G.S.—The author in this note describes a very large Wealden vertebra which he obtained last autumn at Brook, Isle of Wight, remarkable for its great size, its extremely light structure, and the extraordinary development of the processes connected with the neural arch. It consists of a thin outer shell, inclosing a very open cancellated tissue, having extremely large spaces, comparable with those of Pterosauria, and surpassing those of the cancellous tissue in any of the known larger Dinosaurs. A wedge and notch, similar in principle to the ophidian zygosphene and zygantrum, but differently placed, are superadded to the ordinary articular processes. A broad horizontal platform stretches along the side of the arch from the transverse process to the postzygapophysis. The neural spine is composite; all the outstanding parts are supported and strengthened by thin bony plates. Only a small part of the centrum is preserved, so that the form of this, and in particular of its articular faces, is not determinable. The author notices, in conclusion, certain textural resemblances between the vertebra and a peculiar Streptospondylian vertebra in the British Museum, from the Weald of the south-east of England.

Discussion.—The president remarked on the combination of strength and lightness in the bone, which in this respect was not unlike that of the vertebræ of the neck of the ostrich.

"Note on the Middle Lias in the North-east of Ireland," by Ralph Tate, Esq., A.L.S., F.G.S.—The author remarked that hitherto no higher member of the Jurassic series than the Lower Lias has been detected in Ireland. He stated that he had received from near Ballintoy some blocks of a grey, marly, micaceous sandstone, containing an assemblage of fossil forms, indicating that the rock from which they were derived belonged to the lowest part of the Middle Lias, The origin of these specimens, which were obtained "from cultivated fields and patches of drift," was said to be still unknown: and the occurrence of *Hippopodium ponderosum*, associated with Middle-Lias species, as in the Island of Skye, coupled with the agreement in lithological composition between the Irish blocks and the Pabba shales, led him to suggest the possibility that the former may have been transported from the Hebrides by glacial action.

The following specimens were exhibited:—Corals from the South-Australian Tertiaries, exhibited by Dr. Duncan.

ASTRONOMICAL SOCIETY.

ANNIVERSARY MEETING, FEBRUARY 11TH.—In consequence of the illness of the president (Admiral Manners), Professor Adams took the chair. The report of the council on the state of the society, together with the progress of Astronomy during the past year, was read. The chairman delivered an address, after which the medal was presented to M. G. Delaunay for his "Théorie de la Lune." Mr. W. A. Harris was elected a fellow. The society then proceeded to the election of officers and council for the year ensuing, when W. Lassell, Esq., was elected as president.

METEOROLOGICAL SOCIETY.

FEBRUARY 16TH.—Mr. Charles V. Walker, F.R.S., president, in the chair. The following candidates were elected fellows of the society:—F. Andrews, S. H. Miller, F.R.A.S., and Alfred North, F.R.G.S. Several papers were read, viz.:—"Lunar Influence upon the Amount of Rainfall," by J. C. Bloxam, M.R.C.S., F.M.S., "On the Weather of 1869, at Scutari, Constantinople," by Sergeant Tyne, R.E., (communicated by the Rev. R. Main, M.A., F.R.S.), "On the Aurora Borealis of February 1st, 1870," by different observers.

ANTHROPOLOGICAL SOCIETY OF LONDON.

FEBRUARY 15TH.—Dr. Berthold Seemann, V.P., in the chair. C. W. Eddy, Esq., M.A., and E. Schiemann, Esq., were elected fellows. A paper was read by Dr. Barnard Davis and Mr. E. A. Welch, "On the Aborigines of the Chatham Islands."—Mr. Welch, after entering at considerable length into the history and discovery of those islands, described their conquest by the Maories and the ultimate fate of the aborigines. Dr. Barnard Davies gave the results of a particular examination of the characters presented by the skulls and skeletons of many of the inhabitants. In three cases the cephalic indices of the skulls were stated to be ·74, ·74 and ·87. The stature of the Moriories, or Chatham Islanders, appeared to indicate a race shorter and stouter than the inhabitants of New Zealand.

A paper by Dr. J. Campbell was read "On Polygamy: its influence in determining the sex of our race and its effects on the growth of population." The author, who had been many years resident in Siam, gave minute details of the relative proportions of female to male births in the harems of the king and other important Siamese dignitaries. The result seemed to be that the proportions of males and females born were, as in the case of monogamist marriages, entirely equal.

Mr. Ralph Tate described an inscribed rock on the banks of the Iguana, a tributary of the Orinoco. This presented an incised marking which the author considered to be more ancient than the present inhabitants of the district.

STATISTICAL SOCIETY.

THE fourth ordinary meeting of the session was held on Tuesday, the 15th instant, Wm. Newmarch, Esq., F.R.S., president, in the chair. A paper was read by Mr. Ernest Seyd, "On International Coinage and Foreign Exchanges." The following gentlemen were elected fellows of the society—viz., F. T. Hartley, John Hewitt, and H. R. Williams. Foreign honorary members were elected as follows:—Hon. David Wells, Washington, U.S.; Clement Juglar, Paris; and J. Sandford, Boston, U.S. The Hon. Howell Thurlow, the Hague, and A. Mausolas, Athens, were elected as corresponding members.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

ORDINARY MEETING, FEBRUARY 8TH.—J. P. Joule, LL.D., F.R.S., &c., president, in the chair. E. W. Binney, F.R.S., F.G.S., said that in vol. iii. p. 14, of the society's *Proceedings*, he had noticed the occurrence of stray boulders without traces of clay, high up the western slopes of the Pennine chain, and he described one at the extreme end of the valley of the Tame near New Year's Bridge, above Denshaw, in Saddleworth. Many years since he had observed large blocks of greenstone without any clay or sand on Pikelow, to the east of Macclesfield. Both these places were about 1,000 ft. above the level of the sea. Mr. A. H. Green, M.A., F.G.S., and his colleagues, in their valuable memoir on the Carboniferous Limestone, Yoredale Rocks, and Millstone Grit of North Derbyshire, and the adjoining parts of Yorkshire, just published by the Geological Survey, after describing some stray boulders, found by himself and Mr. Sorby, F.R.S., near Rotherham and Sheffield, at p. 133 says, "Our knowledge of the portion of the eastern plain from Sheffield through Chesterfield down to Belper is meagre; we believe we are right in representing it as in the main free from drift, but whether any isolated patches or erratics are to be found in it we cannot say." During a residence of five or six years he (Mr. Binney) had often searched for these boulders in the neighbourhood of Chesterfield. The only foreign rock which he met with in that district was a large block of greenstone several hundred pounds in weight. This he found above the valley of the Hipper near Spring Bank and below the Waterworks station, Chesterfield. The stone was well rounded and polished. He mentioned the fact to direct the attention of observers to this subject on both the eastern and

western slopes of the Pennine chain. Probably they have only to be more diligently sought for in order to be found in greater abundance.

"On Convertent Functions," by Sir James Cockle, F.R.S., President of the Queensland Philosophical Society; communicated by the Rev. Robert Harley, F.R.S., was the next paper.

Mr. Spence then repeated the experiment he had made at the Exeter meeting of the British Association, showing that the temperature of saturated saline solutions could be raised to their boiling points by merely passing through them ordinary steam at a temperature of 212°. Thus, a solution of chloride of sodium was raised to a temperature of 221°, and one of chloride of calcium to 248°. Chloride of sodium would have risen to 224·3° and chloride of calcium to 286° had the experiment been continued, but the point was sufficiently demonstrated that by steam of 212° much higher temperatures can be obtained.

"On the Natural Ropes used in packing Cotton Bales in the Brazils," by Charles Bailey, Esq.—Most of the cotton bales which reach this country from the Brazils are corded with the long stems of climbing plants, which grow in the greatest profusion in the forests bordering on the cotton districts. In their fresh state these stems are exceedingly pliant and of remarkable strength, so that they serve admirably for cordage purposes, but by the time that the cotton reaches the mills of Lancashire they become dry and rigid, and as no further use can be made of them, they are burned for firewood. Being very long, they are very troublesome to put on the boiler fires, and most mill-owners are glad to get rid of them.

These objects are invested with singular interest when examined in regard to their structure, for although the external form of many of them is extremely curious, their chief interest centres in their remarkable internal organization. Although they reach this country in immense quantities, they are not often to be met with in our museums or colleges. It may be questioned whether any one of our public institutions possesses a complete collection of these stems; certainly the names of the plants which produce them are for the most part unknown.

My attention was first directed to them by Mr. Robert Holland, of Mobberley, in a paper which he read on the 7th December last, to the "Manchester Scientific Students' Association," on "Some Peculiar forms of Exogenous Stems," and to this gentleman, to Mr. Randall Alcock, of Bury, to Mr. Alderman Thompson, of Blackburn, to Mr. Richard Thompson, of Padiham, to Mr. Spencer, of Manchester, and to Mr. Griffiths, of Liverpool, I am indebted for an abundant supply of these ropes.

It is not so much my object on this occasion to give a detailed account of the many forms met with, as to give some general description of them, classifying them for the most part under the natural orders to which they probably belong; but I may preface these notes with a short summary of the little which has already been written concerning them.

One of the earliest to minutely study this class of plants was Charles Gaudichaud, a botanist who visited Chili, Peru, and the Brazil in 1830, and who subsequently published a memoir entitled, "Recherches générales sur l'Organographie, la Physiologie, et l'Organogénie des Végétaux" (*Mém. Savans Etrangers*, t. viii., Paris, 1835), in which will be found a large number of engravings of many lianas, but very little descriptive matter; the memoir was written to support the views of Du Pétit-Thouars in regard to the growth of wood, and in opposition to the views of other leading botanists, but little is said about the climbing plants. The most complete general account of their structure which I have met with is that by Adrien de Jussieu—"Sur les Tiges de Diverses Lianes, et particulièrement sur celles de la Famille des Malpighiacées" (*Annales Sciences Naturelles*, t. xv., Paris, 1841); this was afterwards reprinted, with additions, and incorporated in the same author's "Monographie de la Famille des Malpighiacées" (*Arch. du Mus.*, t. iii., Paris, 1843). Another account of their organization is included in the eighth volume of the *Botanische Zeitung*, by Hermann Crüger, entitled, "Einige Beiträge zur Kenntniss von sogenanntnen anomalen Holzbildungen des Dikotylenstammes," and published in 1850. Notices of the structure of other lianas are also to be met with in isolated memoirs, some of which will be referred to, and in most botanical text-books, particularly in those of Lindley, Schleiden, Richard, and Duchartre. Much important information may also be anticipated from some recent memoirs by a Brazilian botanist—Dr. Ladislaü Netto, who has presented memoirs on the subject to the French Academy, extracts from which have only so far been published in the *Comptes Rendus* and *Annales des Sciences*, for 1866, 1867, &c.

Bignoniaceæ.—Travellers in the Brazils tell us that by far the larger number of climbing plants in the South American tropics belong to the natural order Malpighiaceæ, and we should therefore expect that this would be the family which furnishes the majority of natural ropes. But this does not appear to be the case; the Bignoniaceæ stands pre-eminent as the natural order most largely used for supplying lianas for packing purposes, both as regards the quantity of ropes, and the largest number of species.

Most of them are readily identified by the remarkable and symmetrical outlines presented by the cortical and woody systems of their stems when seen in a horizontal section, the bark being projected into the woody tissue, towards the centre, in the form of rays. These cortical rays are wholly formed of liberian fibres, and they vary in colour according to the species. In the majority of stems such prolongations of the bark are four in number disposed after the manner of a Maltese cross. In a few species each of the four cortical portions is very thick and perfectly square in contour, but in the larger number they are long and slender, frequently reaching the pith itself.

The yearly additions to these rays do not proceed after a uniform method, and I shall notice two or three of the principal arrangements. The more common is that where the four primitive rays are deeply projected into the woody portion, the additions taking place each season in the form of plates deposited on each side of the primitive cortical ray. It is difficult without the aid of a diagram to convey a clear idea of the sequence in which the various portions of bark and wood are formed; suffice it to say that each successive addition of bark is projected into the wood a shorter distance than its predecessor, and as the innermost extremity of every plate is truncate or rectangular, it follows that the outline presented by each cortical mass is that of a pyramid, whose sides are formed of a series of rectangular steps like an ordinary stone staircase. It is difficult to account for this singular appearance, but the more probable explanation seems to be that a layer of wood is deposited for every layer of bark, so that by the time a new deposition of the bark is about to take place the wood has already surrounded the extremity of the previous plate, in consequence of which the progress of the new plate inward is barred by the previous season's layer of wood. If this explanation be sound the number of cortical plates on one side of, and including the primitive cortical ray, indicates the age of the stem under examination. Each annular layer of wood is thus broken up into four distinct portions by the projecting bark, each portion filling up one of the spaces inclosed by two of the arms of the cross. The number of plates formed on each side of the four primitive cortical rays rarely exceeds six. The peculiarity of arrangement, to which I here draw attention, is so striking, that it is a matter of surprise to see this feature so badly represented in Gaudichaud's plates; it is fairly drawn by Schleiden in his *Principles of Botany* (pp 251–252 of the English translation); but a better figure is given by Duchartre in his *Eléments de Botanique*, p. 167.

Another arrangement of the cortical portion is also common. It commences, as in the last method, with the projection of four slender rays into the midst of the woody fibres, reaching about half way to the pith; but the next additions which take place are not found by the side of the four primitive rays, as in the first-noticed arrangement, but occur as four new projections placed exactly midway between the first four, so that the stem now exhibits eight of these rays arranged like the spokes of a cart-wheel. At first, the four secondary rays are very much shorter in length than the four primitive rays, but as the stem increases in age all the eight rays become of equal length. Even in this type some species exhibit an approach to the first type, by some of the primitive rays in the older stems having one or two lateral plates lying alongside them.

Perhaps the most striking form of all the Bignoniaceæ which I have hitherto examined is one which unites the peculiarities of both the preceding arrangements, but carried to such an excess as that the cortical portion at last forms one half the bulk of the stem. Originally, the woody portion is arranged in the form of a cross, the bark filling up the whole space inclosed by the four arms of the cross. According as the stem increases in diameter, new cortical rays are projected into the four extremities of the woody mass, so that the arms appear to be bifid; these bifurcations also in their turn become bifid, and so the woody mass has its primary, secondary, tertiary, and quaternary divisions according to its age. Further, as the innermost cortical deposit—that surrounding the woody tissue—is very dark in colour, it throws into high relief the stellate outline of the woody portion. I have met with only one or two species of Bignonia which furnish this elaborate arrangement, and the specimens exhibited will show its striking character.

The woody system of the stems belonging to this natural order is by no means uniform, but it requires careful study before a detailed description can be given. Nearly all the species, however, have numerous vessels of large diameter imbedded in the woody tissue, so that the stems are for the most part very light and porous. Such an arrangement might have been expected in plants whose stems are only as thick as a finger, and whose sap has to travel a long distance before it can reach the leaves, which are for the most part met with only in the uppermost portions of the stems. In most of the species, this woody tissue is traversed by a large number of fine medullary rays, which give a beautiful figure to many of the sections. Their internal arrangement does not manifest itself in any marked way on their exterior; their form is generally cylindrical, but some of them exhibit four slight projections in the form of narrow raised bands arranged lengthwise, which correspond with the outermost portions of the four

cortical rays. Some species have a square stem during their early growth, and even the older stems do not altogether lose their four-sided character.

The constancy of the figure four as the radical number is very noticeable in the structure of the different parts of these stems, and there can be little doubt that it originates in the decussate arrangement of the leaves. The stems of the mints, sages, and many other British plants furnish us with ready examples of a quadruple arrangement of parts.

Malpighiaceæ.—If the lianas which belong to the Bignoniaceæ are remarkable for the symmetry of their parts, the lianas of this family may be said to the characterized by an absence of symmetry. In general, their stems are singularly rugged in outline, a section presenting deep sinuosities or irregular projections, while at other times they appear to be made up of a number of separate branches which have become consolidated in the progress of growth, so as to form a rough looking rope of many strands.

Jussieu gives a full and interesting account of the structure of one of these stems, the *Stigmaphyllon emarginatum* (*Mémoire*, &c., pp. 103, &c.), and Gaudichaud ("Recherches," &c., pl. xviii. fig. 11, p. 129) figures an allied species, but I have not, as yet, identified either amongst those coming with cotton. I exhibit however a stem which appears to be the *Tetrapterys Guilleminiana* referred to by Jussieu, and figured by him in his monograph, plate iii. fig. 5, p. 106; but this species does not exhibit the sinuosities so characteristic of most of the lianas of this family.

As a general rule, the woody matter is developed unequally round the central pith in the form of irregular lobes, the bark closely following all the sinuosities of the stem. If the lobes increase on one side of the stem only, the pith soon becomes excentric; but, on the other hand, in many species, while the pith retains its central position, the irregular growth of the woody lobes—each of which is closely invested by the bark—causes some to grow beyond their neighbours, and these latter, in the progress of growth, become imbedded, with their bark, in the midst of the woody matter produced by the more vigorous lobes. A stem in this adult state therefore presents the greatest irregularity of form particularly in the genera Banisteria and Heteropterys.

Sapindaceæ.—In this natural order we meet with some wonderful aberrant forms of dicotyledonous stems, but I shall here notice only two which are met with on cotton bales.

One of these is most probably the *Serjania cuspidata* figured by Duchartre (*Elements*, &c., fig. 82, p. 170) and Schleiden (*Principles*, fig. 168, p. 253), and easily recognized by its triangular form and compound character. It consists of a primitive setm not specially noticeable for any divergence from the usual type of a dicotyledonous stem; but round this stem are arranged three other lateral stems, each of which has its own bark separate from the rest, but united to the bark of the primitive central stem. These lateral portions are circular in outline, save that they are flat on the side by which they are attached to the central stem, which latter is in consequence hexagonal. The attachment of the lateral portions to the central mass is not very firm, as most of the ropes of this species reach this country with their strands separated, but this is due to the rough usage to which they have been subject in packing; but Gaudichaud points out that in certain parts of the stem—most likely at the nodes, for he is not very clear upon the point—the lateral strands have an organic attachment to each other, since some of the woody fibres of the central mass are continued in one of the lateral strands, and *vice versâ*. ("Recherches," pl. xiii. figs. 2 and 3, p. 110.)

A still more remarkable example supplied by this family in the form of a natural rope is one which might have served our telegraph engineers as the model of a submarine cable. Like the Serjania, there is a central woody mass possessing a medullary sheath and pith, woody layers, and a cortical system; but surrounding this central core and arranged parallel with it is a series of eight lateral strands, each surrounded by its own bark, the whole being consolidated so as to form a rigid cylindrical axis, which presents no external manifestation of its peculiar internal organization. It is represented in the last figure of Gaudichaud's "Recherches" (pl. xviii. fig. 21, p. 130), and has been copied into most of our text-books, in some cases incorrectly described as a Malpighiaceous plant, as by Professor Balfour in his *Class Book*, figs. 186 and 1,429.

On examining such stems of this order as I have been able, the pith and medullary sheath with its characteristic tracheal vessels appear to be met with in the central mass only, and some botanists, contrary to the opinion expressed by Jussieu (*Mémoire*, pp. 116, 117), doubt the existence of these organs in the lateral strands. Nevertheless, one of the most recent observers of these stems, Herr Nägeli, has recently demonstrated their presence in each of the surrounding woody masses (*Dickenwachsthum des Stengels...bei den Sapindaceen*. Munich, 1864).

A short summary of their mode of growth, communicated to the French Academy by M. Netto, will be found in *Comptes Rendus*, t. lvii. pp. 554–557, Sept. 21, 1863, from which it would appear that a young stem, two to three weeks old, exhibits a number of fibro-vascular bundles in the midst of an outer zone of cellular tissue, one bundle being formed opposite the innermost portion of each of the external grooves of the stem; so that from its very earliest stage the stem exhibits all the rudiments of the lateral strands which surround the core. Around each of the fibro-vascular bundles a mass of liber is formed, at first crescent-shaped, but afterwards annular; and by the growth and union of these several parts the stem soon assumes its peculiar composite character.

Leguminosæ.—Another group of lianas presenting some external resemblance to the sinuous Malpighiads, is met with in plants which belong to this natural order of the genera Bauhinia and Schnella. In the Brazils they bear the name of *Cipo d'Escada*, from their resemblance to a ladder, but Jussieu restricts this name to the *Schnella macrostachys* (*Mémoire*, p. 118).

They are chiefly remarkable for depositing their woody fibres on two sides only of the central pith, so that their stems have a singular flat tape-like appearance, presenting in section the outline of an elongate ∞, the position of the pith being at the intersection of the two loops. The pith, however, by no means maintains its central position, for according to the researches of M. Netto, the growth of branches brings about a lateral deposit of woody matter, sometimes on one side and sometimes on the other, so that the pith soon becomes excentric. The pith is generally in the form of a small Maltese cross, formed of two unequal arms, the longest of which lies in the direction of the largest diameter of the stem.

There are many other forms of Bauhinia, many of which will be found figured in the standard works of Lindley, Schleiden, Richard, Duchartre, &c.

Aristolochiaceæ.—It is very likely that this natural order has representatives amongst these ropes; at least to it I refer for the present two species remarkable for their very striking medullary rays.

In both species these rays proceed from the pith to the bark, increasing in breadth and volume as they recede from the pith, so that by the time they reach the bark they become of considerable thickness.

In one species, whose wood has a reddish tinge, there are about nineteen or twenty of these magnificent rays in a stem exceeding half an inch in diameter; the intermediate spaces are filled up with woody fibres, in which occur large vessels. In this species secondary medullary rays rarely make their appearance. But in the other species, which has a beautiful cream-coloured wood of the shade of our common holly, secondary and tertiary medullary rays make their appearance, so that in a stem three quarters of an inch in diameter there will be as many as thirty primary rays, and as many more secondary rays. In this, the commoner species of the two, the cortical system is much thicker than in the first-mentioned species. Both bear much resemblance to a wood-section in my cabinet which is called "New Zealand Pepper," a plant of which I am quite ignorant.

Ampelideæ.—Gaudichaud in his memoir ("Recherches," plate xiii. fig. 5, p. 109) gives a figure of the *Cissus hydrophora* as one of the common lianas of the Brazil, but I am not sure whether it occurs amongst the ropes which reach this country. It is described by M. Netto (*Annales des Sciences*, 5th ser. Bot. t. vi. p. 320; *Comptes Rendus*, tom. lxii. p. 1,076), and a short summary is worth transcribing, as he had the advantage of studying the living plant.

In the section of a young stem, beginning with the bark, we have first a suberous layer, then a thick cellular layer containing very little chlorophyll; and having at the side nearest the bark a mass of dotted cells whose walls become very thick. On the inner edge of this cellular layer we meet with a number of liberian bundles in front of some woody bundles; the latter are strikingly subdivided by the adjacent parenchyma into separate groups so as to cause it to look more like the arrangement generally seen in a monocotyledonous plant.

M. Netto mentions that the structure of the woody mass is even more remarkable, since in the place of the ordinary medullary rays, cellular bands are projected from the bark towards the pith which form cortical rays. Another peculiarity of the woody part is that, notwithstanding it may be two years old, the woody fibres are so loosely held together that they readily detach themselves from the cellular tissue in which they are imbedded. The stem must be at least three years old before it attains anything like consistency; this weakness, as contrasted with other lianas, probably leads to its not being so frequently used for packing purposes.

There is one histological character, however, presented by this liana which will lead to its identification, and that is the abundant quantity of raphidian crystals contained in all parts of the stem. M. Netto describes the form of these crystals as needle-shaped, but bifurcate at one extremity—which is peculiar.

However abnormal many of the stems belonging to these various orders may become, and however difficult it may be to trace their divergency from the normal structure, there can be no doubt that the characteristic elements of the dicotyledonous stem are all present during some portion of their lives. Their unequal development may be brought about either by the vital energy of the growing tissue of the bark being in excess of that of the wood, or *vice versâ*, from which circumstance will arise the curious outlines presented by the

relative distribution of each; or else it may be produced by a much more copious deposition of woody tissue at some points of the circumference than at others, from which will result the curious forms presented by the Bauhinias and many of the Malpighiaceæ.

The monocotyledonous division of the vegetable kingdom has also its representatives amongst these ropes. There are two species, perhaps belonging to the grasses, which I have met with; but in neither case is the entire stem used. One species is much larger than the other, their diameters being about 2 in. and 4 in. respectively; both are hollow and are divided into strips for use.

There are many other species found amongst these ropes which belong to other natural orders, such as the Menispermaceæ, Gnetaceæ, Asclepiadaceæ, &c.; but our knowledge of them is too limited to assign them to their respective orders. Most of my specimens have come from bales of Santos cotton, and it would be as well to keep a record of the localities from whence they are derived. I am very anxious to get some from the Pacific coast, where many species differing from Brazilian species must be found. Gaudichaud mentions the neighbourhood of Guayaquil, in Ecuador, as being particularly prolific in these lianas.

I will conclude with a notice of another species which was sent me from the Liverpool docks by Mr. Griffiths, whose structure is so puzzling that I know not whether to call it dicotyledonous or monocotyledonous. It consists of a central spongy mass of woody tissue apparently without medullary sheath, pith, or medullary rays, and arranged in the form of a pentagon formed of semicircular lobes, the whole being surrounded with what appears to be liber which has shrunk away from the very thick and hard external bark, so as to leave the woody core isolated within it. The core consists of woody fibres, but half its area is taken up with wide-mouthed vessels.

I may add that the whole of these lianas furnish beautiful objects for the microscope.

Mr. Forrest suggested that useful dyes might be obtained from the plants described by Mr. Bailey.

In reply to a question from the Rev. Brook Herford, Mr. Bailey stated that owing to a difference in the structure and general appearance of some of the stems in his possession he had been led to suspect that they were aërial roots of some of the plants he had exhibited and described.

BRISTOL MICROSCOPICAL SOCIETY.

WEDNESDAY, FEBRUARY 16TH.—Mr. W. J. Fedden, president, in the chair. The minutes of the preceding meeting were read and confirmed, and some other business transacted. Mr. Roper was balloted for, and elected an honorary member of the society. Mr. T. G. Ponton, F.Z.S., hon. secretary, then read a paper "On some points in the Anatomy of *Tegenaria domestica*," the house spider, especially in reference to the nervous and circulatory systems.

GLASGOW PHILOSOPHICAL SOCIETY.

(CHEMICAL SECTION.)

ORDINARY MEETING, JANUARY 31ST.—Dr. William Wallace, F.R.S.E., vice-president, in the chair.—Mr. John Christie, of Alexandria Turkey Red Works, Dumbartonshire, read a paper "On the History of Madder, the Various Investigations Relating to its Character and Composition, and the Proposed Sources of Artificial Alizarine."—The author, with considerable detail, traced the history of madder-dyeing, from its origin in Eastern India, 3,000 years ago, through Persia, to Adrianople, Greece, Italy, and Western Europe. The colours were first obtained from Munjeet; then came into use the Turkey madder-root. This plant was first grown in England in 1624, at which time three qualities were known—cropp, fatt, and mill madders. In the year 1798 there were only eleven madder-mills in the whole of France, while now in the department of Vaucluse alone there are no fewer than 50 in operation. French madder-root has a peculiar smell, and a taste between bitter and sweet. Some kinds, as those of Alsace and Holland, when mixed with water and allowed to stand for some time, give a thick jelly; this is not yielded to the same extent by Avignon madder. If this madder is treated with an acid it produces a perceptible effervescence, owing to the quantity of calcic carbonate which it contains.

Towards the close of last century, scientific investigators and the more intelligent of the dyers and printers were led from various circumstances to suppose that madder contained two colouring matters, a red, and what they then called a tawny colour. The author mentioned the results of the investigations of Watt, Charles Bartholdi, and Hausmann, and stated that, in 1823, M. T. Kuhlman published a complete approximate analysis of madder. That chemist found a red colouring matter, which he specially searched for, and another matter of a fawn colour, which he did not consider worthy of investigation. He prepared the red colouring matter by steeping madder-roots in water for twenty-four hours, then boiling the washed madder with a fresh quantity of water, filtering the decoction hot, and then adding sulphuric acid, when a flocculent precipitate of an orange colour was produced. He again filtered and washed the precipitate with acidulated water. What he thus obtained was his *matière colorante rouge*. This he purified by dissolving in absolute alcohol, to which a small quantity of dry pulverized potassium carbonate was added; the alcohol acquired an intense crimson-red colour. After filtering and allowing the filtrate to evaporate spontaneously, he obtained small crystals like fern-leaves, and having the following properties: —(1) Great solubility in alcohol, and imparting to it a beautiful red colour; (2) solubility in water, the colouring matter altering in the concentrated solution, and being precipitated; (3) the solubility in water greatly facilitated by alkalis without any material alteration of the shade; (4) it is precipitated as an orange colour from solutions by acids.

Mr. Christie next referred to the researches which were made on Alsace madder by Robiquet and Colin, and published in 1826. Those chemists obtained two colouring substances, one of them being what they considered no other than the particular colouring substance of madder, and which they named *alizarine*, from the modern Greek name for madder. The other substance they considered to be a modification of alizarine, and from the colour which it took when freed from the acid used to precipitate they called it *purpurine*. In the following year, by pursuing a somewhat different process, Gautier de Clauby and Persoz obtained two colouring matters—*matière colorante rouge* and *matière colorante rose*. Their distinctive properties are thus shown:—

Red.	Rose.
Fracture brilliant.	Fracture resinous.
Attacked by ammonia warm.	Attacked by ammonia cold.
Caustic alkalis give red colour.	Caustic alkalis give purple colour.
Insoluble in alum liquor.	Freely soluble in alum liquor.

In the hands of the same chemists madder yielded, by treatment with sulphuric acid, and subsequent washing with cold water, a preparation of great tinctorial power, which was at first called *sulphuric carbon*, and some time later *garancine*. The manufacture of this substance on the large scale was undertaken by MM. Lagier and Thomas, of Avignon, in 1829.

The author gave a full outline of the investigations which Dr. Edward Schunck made in 1848. Seven substances were obtained by Schunck: two colouring bodies, two resins, a bitter substance, pectic acid, and a dark brown substance. One of the colouring bodies was alizarine, to which he gave the formula, $C_{14}H_{10}O_4$; for the other, which he named *rubiacin*, he proposed the formula $C_{32}H_{22}O_{10}$. Pursuing a different process, Dr. Debus, in the same year, investigated Zeeland madder. He called one of the colouring bodies *lizaric acid*, and proposed for it the formula $C_{30}H_{20}O_9$; and the other he called *oxylizaric acid*. Its composition was:—

Carbon	66·40
Hydrogen	3·86
Oxygen	29·74
	100·00

The last mentioned substance was obtained to the extent of about 4 or 5 grains from 20 lb. of madder.

Drs. Wolff and Strecker, pursuing a process very similar to Schunck's, obtained in the year 1850, both alizarine and purpurine. The latter they regarded as oxide of alizarine. Their conclusions were summarized thus:—(1) Madder contains two colouring matter—alizarine and purpurine. (2) Alizarine changes into purpurine when madder is fermented. (3) Alizarine and purpurine, when oxidized with nitric acid, give phthalic acid. (4) Chloronaphthalic acid is chloride of alizarine.

According to Strecker, if the formula of alizarine be taken as $C_{10}H_8O_3$, and one atom of chlorine be substituted for one atom of hydrogen, an interesting relationship is observable between that compound and chloroxynaphthalic acid, $C_{10}H_5ClO_3$. The author said it would thus seem likely that alizarine, or a body very similar to it, might be produced from chloroxynaphthalic acid. Schützenberger and Lauth have replaced the chlorine in that compound by hydrogen, but the new body had not the properties of alizarine, the composition of which, according to Schützenberger, is very probably $C_{20}H_{12}O_6$. P. and E. Depouilly, by boiling chloride of chloroxynaphthalic acid, $C_{10}H_5ClO_3.Cl$, with solution of potash, and subsequent treatment with mineral acids, obtained, as a yellow crystalline powder, a body which sublimed in beautiful needles, and whose alumina salt is a deep red, like the colour given by madder. The iron salt is nearly black, and although it resembles alizarine in many points, Schützenberger states that trials made at Mulhouse to use it had not been satisfactory.

The next point referred to in the history of alizarine was the fact that Dr. Anderson, of Glasgow, had treated opianic acid, $C_{10}H_{10}O_5$ ($=C_{10}H_6O_3+2H_2O$), with sulphuric acid, and obtained a colouring matter which was probably alizarine, as it yielded all the madder colours on alumina and iron mordants. According to Clarke, who obtained a patent for the process in 1861, artificial alizarine is obtained

from dinitronaphthaline, and is capable of yielding all the madder colours. More recently Professor Rochleder, of Prague, has obtained besides alizarine and purpurine, a small quantity of a colouring matter which reacts very like chrysophanic acid obtained from rhubarb root. When crystallized from absolute alcohol it has the composition $C_{14}H_{10}O_4$, and when it is distilled with powdered zinc it yields anthracen, $C_{14}H_{10}$. Graebe and Liebermann noticed that natural alizarine, by distillation with powdered zinc, yielded a hydrocarbon, which, instead of being naphthaline, $C_{10}H_8$, as they expected, proved to have the same composition as Dr. Anderson, Berthelot, and others had given to anthracen; and, believing that this was the proper source to start from in the preparation of artificial alizarine, they set to work to test the truth of the opinion. They were so far successful that they obtained a product closely allied in many of its properties to the colouring matter of madder, and in December, 1868, they obtained provisional protection for their process in this country. Mr. Christie detailed the process, stating that the patentees obtain in the first stage of the process anthrachinon, $C_{14}H_8O_2$, by the use of bichromate of potassium—

$$(C_{14}H_{10} + K_2Cr_2O_7 = C_{14}H_8O_2 + 2KHO + Cr_2O_3).$$

In the second stage they convert the anthrachinon into bibromanthrachinon, $C_{14}H_6Br_2O_2$, a solid substance which is purified by crystallization from benzol. In the third stage this new compound is transformed into artificial alizarine by treating with potash, heating to 180° or 260° C. till a deep blue colour results, then dissolving in water, filtering, and precipitating the alizarine by acid. They obtained provisional protection for a second patent last year.

Pursuing a somewhat different course, Julius Brönner and Herman Gutzkow, of Frankfort-on-the-Maine, matured a process which they patented in May, 1869, and which, they state, yields two colouring matters that can be employed for dyeing or printing, either with or without mordants. One of them colours alcohol yellow, and the other colours it red or violet.

Mr. Christie completed his historical *résumé* by referring to Mr. W. H. Perkin's process, patented 26th of June, 1869, by which artificial alizarine is obtained from anthracene, by oxidizing with bichromate of potassium to produce anthrachinon—a process which has recently been modified by the use of a new acid derived from anthrachinon in place of bibromanthrachinon.

The author then referred, at considerable length, to experiments which he had recently made with Perkin's artificial alizarine, and with one made by a secret process by MM. Lucius & Co. of Hoechst, near Frankfort. Amongst other things, he stated that while natural alizarine, prepared from the finest garancine, fused at 320° F., and was almost entirely sublimed by exposure to a temperature of 340°, the artificial alizarine only yielded a sublimate when the temperature was raised to 420° F. There was no fusion, and only 15 per cent. of the powder was sublimed, even though it was kept at a temperature of 450° for a whole hour. No fusion ensued, and no further sublimate was produced, though the powder was slowly heated to 600°, at which temperature it was kept exposed for some time. Mr. Christie showed to the members an interesting experiment to demonstrate the truth of his opinion that artificial and natural alizarine are not identical. He placed swatches of dyed cloth in caustic soda solution (30 grains to the gallon of water). Those dyed with the artificial alizarine of Perkin and Lucius & Co., in a short time threw off a deep crimson colour, which rose to the surface of the cloth, and, flowing down the swatch, fell in streaks through the alkaline liquor; while those dyed with natural alizarine and with garancine threw off no colour to affect the soda solution. He had found that selected crystals of artificial alizarine had only one-half the tinctorial power of the natural product. He concluded by saying that, from the several experiments which he had made, his opinion was that, although the substance now sold as artificial alizarine may be the best attempt to produce the alizarine of madder by chemical means, in its present state it is far from being identical with it.

A very animated discussion followed, in which Messrs. Anderson, Hogg, J. W. Young, Smith, Paterson, and the chairman took part.

Mr. Hogg strongly combated the opinion that the two products are not identical. He questioned the absolute purity of Mr. Christie's artificial alizarine, and said that, unless it was not only sublimed, but several times re-crystallized from alcohol, it would be impure; and, further, that the coloration imparted to the alkaline liquor was doubtless due to the presence of another colouring matter which is known to be present in ordinary commercial artificial alizarine. He also stated that mordanted cloth dyed with pure artificial alizarine stands soaping better than that dyed with garancine: that was the testimony of many persons who had worked with the colour.

Mr. J. W. Young said that he had found that cloth prepared with the artificial alizarine would stand even boiling with soap.

Mr. Smith stated that he considered that he had established the identity of the crystals of the two products by microscopic examination.

In proposing a vote of thanks to Mr. Christie, the chairman referred to the highly interesting nature of the inquiry, and complimented that gentleman upon the extensive researches in which he had been engaged, as shown by his very elaborate paper. The proposal was most heartily agreed to.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, FEBRUARY 14TH.—The correspondence was presented by M. E. de Beaumont. It contained a note by M. de Luca, entitled Chemical and Therapeutical Researches on the Thermal Water of the Solfatara of Pozzuoli. In a preceding communication, made to the Academy in November, 1868, the author had stated his suspicions that this water owed its therapeutic powers to the presence of some substance that had hitherto escaped detection. He is now able to assert, as the result of his experiments, the presence of arsenic in this thermo-mineral water. For its detection Marsh's apparatus was employed, with the modification made by Thenard, of having a close spiral of copper wire in the tube, to receive the arsenical deposit. The water contains also free sulphuric acid, and members of the alum family.

General Morin read a report on the works of M. Tresca relating to the flowing of solids, in the name of a commission formed of MM. Combes, De St. Vénant, and Morin.

M. de St. Vénant next read a report on the memoirs by M. F. Lucas on the equilibrium of atoms, in which, starting from certain hypotheses not in accordance with the known properties of bodies, he arrives at results which are not without interest.

M. Bouley presented, in the name of M. André Samson, a book on the hygiene of animals. This book is said to be written from an entirely novel point of view. The author has devoted his attention not so much to the means of preserving the health of animals, as to the means of rendering them sound or diseased in the way, and to the extent desired, for the greater profit of the proprietor. In writing it, therefore, the rearer has been considered, and not the animals themselves.

M. Milne-Edwards announced that a rare collection of mammals and birds had been sent to the museum by the Abbé David, from the eastern part of Thibet, a district not hitherto explored by naturalists. The animals in the collection are being examined in the museum.

M. Claude Bernard presented a note by M. P. Bert on the action of green light on the sensitive plant. After some time this light causes the effects of darkness upon the plant, first depriving it of its sensibility, and then killing it.

M. Zalewski read a short note on a galvanic pile with three liquids. The following are its elements:—carbon, nitric acid, first porous cell, sulphuric acid, second porous vessel, ammonium chloride, and zinc. The inventor considers batteries thus arranged to be, in spite of their complexity, more convenient for use when large quantities of electricity are required with regularity than other forms.

M. Combes presented, in the name of the Abbé Moigno, the translation of Professor Tait's work on the dynamic theory of heat.

SOCIÉTÉ PHILOMATHIQUE OF PARIS.

PARIS, JANUARY 22ND.—At this meeting M. Flye Saint Marie, presented a paper on the postulate of Euclid. Euclid's axiom (XII.) about parallel lines, though just as evident as the others, can yet be denied without the denial carrying anything with it contrary to our conceptions. This suffices to explain the frequency of researches on the theory of parallels, but it remains to be explained why so many efforts have proved fruitless, and to be seen whether or not it is possible to surmount the difficulty through which they have failed. This problem the author set himself to solve, and he believes he has succeeded in doing so.

THE ROYAL ACADEMY OF BELGIUM.

DECEMBER 4TH.—At this meeting which we partly reported last week the following papers were also read:—

Professor Pérard, of Liége, read a note on a modification of Nairn's electrical machine, which gives much stronger sparks, and produces much more powerful effects, than can be obtained with the ordinary machine. The modification consists in suspending a Leyden jar from each of the conductors of the machine, and connecting the outer coatings of the two jars by a chain. The permanent and complete neutralization of the two coatings thus united gives great energy to the condensation. By employing jars 160 millimètres high, and 90 in diameter M. Pérard has succeeded in piercing a plate of glass 6 millimètres thick, although the glass cylinder of the machine was only 50 millimètres in diameter, and the cushion 380 long. In its ordinary state this machine gives a spark which passes between the extremities

of the branches across a space of 45 millimètres; but when the jars are placed as described, the spark occurs much less frequently, and is much louder and more vivid, and can be obtained 100 millimètres long, or even 170 when the atmospheric conditions are favourable. This spark has not the continuity of that of Holtz's machine or Ruhmkorff's coil, but it is much more powerful than the first, and may be compared to that of a large coil for amplitude and brilliancy. The detonation of the spark 170 millimètres long is as loud as that of the spontaneous discharge of a battery of six Leyden jars.

M. Louis Henry communicated the second and third parts of his researches on the ethereal derivatives of polyatomic acids and alcohols. The second part consists of a continuation of the general considerations of the phenolic ethereal combinations, and a description of anisic nitrile and its mononitro-derivative. The third part treats of the ethereal derivatives of phenylic phenol, monochlorinated methylic phenol, and monochlorinated ethylic phenol. These chlorinated bodies are obtained by the action of pentachloride of phosphorus on the respective phenolic ether; in the reaction, the pentachloride behaves as if it were a mixture of free chlorine and phosphorus trichloride.

THE VIENNA ACADEMY.

VIENNA, JANUARY 22ND.—The Academy learned from the Government, by letter, dated January 11th, that the French Government have decided on summoning an International Commission to Paris to prepare from the standard mètre in the Archives of the French empire a legally authorized copy, and particularly to take part in all experiments and determinations which may be requisite to place beyond doubt the accuracy of the copies of the standard measure existing in the Archives.

The French Government have invited the Austrian Government to allow itself to be represented at this International Commission by a scientific deputation. The Government therefore invited the Academy to choose one of its members to take part, in the name of the Government, in the work of this International Commission, in conjunction with Professor Dr. Joseph Herr and the representatives chosen by Hungary.

The Government also sent in, with a note dated January 17th, a specimen of a nautical instrument, "Correttore delle Corse," invented by Navy-Inspector Carl Zamara, for making corrections in the course and the azimuthing for the deviation of the compass.

Herr Haidinger presented a note by Professor G. Hinrichs, of Iowa, on the structure of quarts. An atom of quartz is regarded as consisting of one atom of silicium and two atoms of oxygen, triangularly arranged, and thus giving rise to the equiangular three and six-sided arrangements in the crystals.

Professor E. Mach sent in a research on the vibrations of stretched cords, carried out in the physical laboratory of the University of Prague by Herr Clemens Neumann. The author has observed, by very different and partly very singular methods, both the movement of particular points in the strings and also the movements of the entire strings.

Dr. Boué presented a geographico-geognostic map of the Valley of Sutchesa, remarkable for its narrow passes, numerous dolomite peaks, and high mountain ridges, through which lies the direct way from Fotscha to the table-land of Gatzko, in the Herzegovina.

Dr. Friedlowski presented a memoir on three forms of enlargement of the carpal and tarsal bones in man.

Professor F. Simony presented a comparative view of the temperature relations of the Hallstätter Lake, Gmunder Lake, and the two Langbath lakes, in which he had taken the temperatures at all depths at the same periods of the years 1868 and 1869, with the view to make out the extent of the influence of the different climatic characters of these two years on the temperature of lakes.

Dr. J. Hann presented a memoir on the diminution of temperature with the height of the earth's surface.

ROYAL INSTITUTION OF LOMBARDY.

MILAN, DECEMBER 23RD.—In the absence of the president, Signor Brioschi, through indisposition, Signor Castiglioni presided.

Dr. P. G. Maggi read a paper on a Portuguese translation in verse of the *Gerusalemmo Liberata*, by Señor Ramos Coelho, submitted to the Institution by the author.

According to the regulations of article XV. of the bye-laws, Professor Carlo Cantoni explained some of the results of his studies on human intelligence, and commenced by discussing at this meeting the diversity between the perceptive faculties of man and those of animals.

Professor Giovanni Cantoni read a short note on the efficiency of a modification of the frictional electrical machine.

With a few brief statements Professor B. Crivelli presented a work, in the names of Professor Leopoldo Maggi and himself, which they had carried out together, on the correspondence between the breadth of the *Vibrio-bacillus* and the diameter of the morphological elements from which they are derived.

Dr. Lombroso, in connection with his paper read at the last meeting,[1] exhibited samples of flour and bread prepared in a new way, and such that they could be kept for a fortnight without fear of their turning bad and becoming mouldy. He then made a communication on the symptomatology of pellagra.

After transacting some of the internal affairs of the Institution the meeting rose.

NOTES AND MEMORANDA.

The Utilization of Sewage and the British Association.—At a meeting of the committee of the British Association on the Treatment and Utilization of Sewage, at which there were present R. B. Grantham, Esq., C.E., F.G.S. (in the chair); Professor Marshall, F.R.S., J. Thornhill Harrison, Esq., C.E., J. Bailey Denton, Esq., C.E., F.G.S.; W. Hope, Esq., V.C., and Professor Wanklyn, F.C.S.; the honorary secretary presented the list of subscriptions from the various towns contributing towards the expense of a practical and comprehensive inquiry into the treatment and utilization of sewage. He reported that he had addressed the circular to 663 Corporations and Boards of Health, and received replies from 245. The following towns subscribed the sums placed opposite their names:—Manchester, £100; Halifax and Plymouth, £30 each; Bath, Cardiff, Exeter, Greenock, Hanley, and Ipswich, £21 each; Oxford, £15. 15s.; Burslem, Cambridge, Coventry, Devonport, Dewsbury, Doncaster, Durham, Gloucester, Hereford, Keighley, Longton, Macclesfield, Maidstone, Paisley, Reading, Shrewsbury, Torquay, Wakefield, West Derby, and West Hartlepool, £10. 10s. each; Derby, Kendal, and Todmorden, £10 each; Windsor, £7. 7s.; Abergavenny, Abingdon, Balsall Heath, Bradford, Bridport, Bromley, Carlisle, Cheshunt, Cottingham, Dartford, Daventry, Eastbourne, Ely, Enfield, Eton, Fenton, Frome, Gainsboro', Guildford, Harborne, Hertford, Lichfield, Louth, Malvern, Newport (Hants), Northam, Pennington, and Westleigh, Penzance, Ripley, Rusholme, Sheerness, Stoke-on-Trent, Swaffham, Torteth Park, Walker, Walton-on-the-Hill, Waterloo, Wavertree, Wellingborough, and Weymouth, £5. 5s. each; Crewe, Ormskirk, Ware, and Wells, £5 each; Littlehampton, £3. 3s.; Atherton and Stretford (Lancashire), £2. 2s. each. The subscriptions amount to £786, exclusive of the £50 given by the British Association. Of those towns and districts which replied to the circular and did not contribute, 25 deferred their decision for consideration, and 23 merely acknowledged the receipt of the application without any intimation as to their intentions, while the remainder, amounting to 116, refused on various grounds, some because they thought the inquiry ought to be conducted at the expense of the country generally, and some because, though they approved of the inquiry, they were too poor to contribute. Others also approving of the inquiry came to the conclusion that they had no legal authority for contributing, while there were three only that disapproved of the inquiry. A few declined on the ground that sewerage works already existed in their districts with arrangements for the utilisation of the sewage. 418 towns and districts made no response at all. The Metropolitan Board of Works declined to contribute on the ground that the Act of Parliament, under which it was constituted the representative body of a population equalling one-sixth of that of the entire country, does not contemplate such a use of ratepayers' money. The Committee, after a careful consideration of the matter, was of opinion that the amount already subscribed was sufficient to justify the commencement of the inquiry, but that unless a larger number of places joined in contributing, the inquiry would not be sufficiently extended. It was therefore determined first to forward to every town and district, subscribing or not, the list of subscriptions with this statement of the intentions and views of the committee, and, secondly, to request the authorities of the subscribing towns to state the nature of the difficulties under which they severally suffer.

Patent Waterproof Washable Paper-hangings.—Every one knows how costly are handsome wall papers, how easily soiled, how impossible to cleanse, and how readily destroyed by damp. These objections, however, are all obviated by a most ingenious invention, termed the Oleo Charta, of Messrs. Lee & Co. A sample of these, sent us by the manufacturers, has been submitted to examination, and with the best results. The patterns, which were of great delicacy and beauty, were submitted to the influence of soap and water, with no other effect than to remove some dust stains which had been allowed to mark them. The great advantage of these new paperhangings is that, besides their sanitary qualities (keeping out damp and preventing the particles of colouring matter from getting into the air) they can be regularly washed clean when occasion demands. We commend them to the favourable attention of our house-improving readers.

[1] See SCIENTIFIC OPINION, vol. iii. p. 183.

Artificial Kirschwasser.—The genuine alcoholic fluid of this name owes its flavour to the presence of a small quantity of hydrocyanic acid and ethereal oil of bitter almonds (hydruret of benzoyl). The author suggests that, when a certain quantity of the young leaves of the peach-tree (a handful is named) is beaten up in a porcelain mortar, next digested with 4 litres of water during two days, and this mixture added to 2 litres of strong alcohol (94 per cent.), and submitted to distillation, and the distillate diluted with water to a strength of 60 per cent. alcohol, a fluid is obtained fully equal in taste and aroma to the best Swiss kirschwasser made from cherries bruised up with the stones and kernels they contain. The author cautions against the drinking of too large quantities of this liquor; and so he may, since cases of accidental poisoning with this and similar alcoholic liquors (Persico among the number) are by no means rare.—*Pharmaceutische Zeitschrift für Russland*, through *Chemical News*.

A Correspondent of the *Times* makes out the actual value of our bronze coins to be about one-fourth of that at which they are current.

SCIENTIFIC DIARY.

WEDNESDAY, February 23rd.

Society of Arts, 8 p.m. "On Economy in the Use of Fuel for Domestic Purposes," by Capt. Douglas Galton, C.B.
Geological Society, 8 p.m.
British Archæological Association, 8 p.m.
Royal Society of Literature, 8.30 p.m.
Belfast Natural History and Philosophical Society, and the Naturalists' Field Club, joint meeting, 8 p.m. A lecture "On the Continuity of the Liquid and Gaseous States of Matter," by Dr. Andrews, F.R.S.

THURSDAY, 24th.

Royal Society, 8.30 p.m. "On certain Lichens," by Dr. Stenhouse, F.R.S. "On the Successive Action of Sodium and Iodide of Ethyl upon Acetic Ether," by Dr. Frankland, F.R.S., and B. F. Duppa.
Society of Antiquaries, 8.30 p.m. "On the Guilds at Wymondham, Norfolk," by G. A. Carthew, Esq, F.S.A.
Zoological Society, 8.30 p.m. "On the Classification of the Capitonidæ," by Messrs. Marshall. "On the White Wag-tails of China," by Mr. R. Swinhoe. "On the Deer Living in the Society's Menagerie," by Mr. Sclater.
London Institution, 7.30 p.m.
Philosophical Club, 6 p.m.
Newcastle Chemical Society, 7.30 p.m.
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.

FRIDAY, 25th.

Royal Institution, 8 p.m. "The Ordnance Survey of Sinai," by Capt. Palmer.
Quekett Microscopical Club, 8 p.m.
Clinical Society, 8.30 p.m.

SATURDAY, 26th.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. "Science of Religion," by Prof. Max Müller.

MONDAY, 28th.

King's College, 8 p.m. Prof. Guy's Lectures.
Royal Geographical Society, 8.30 p.m.
Society of British Architects, 8 p.m.
Institute of Actuaries, 7 p.m. "On the Proper Method of Loading the Premiums required for the Grant of Life Annuities and Assurances," by Mr. W. M. Makeham.
London Institution, 4 p.m.
Torquay Natural History Society, noon. Lecture on the Geology of Devonshire, by W. Pengelly, F.R.S.

TUESDAY, March 1st.

Royal Medical and Chirurgical Society, 8.30 p.m. Anniversary meeting.
Institution of Civil Engineers, 8 p.m.
Anthropological Society, 8 p.m. "The Circassian Slaves and the Sultan's Harem," by Major Frederick Millingen, F.R.G.S.
Syro-Egyptian Society, 7.30 p.m.
Leeds Philosophical and Literary Society, 7.30 p.m. "On the Results of Spectrum Analysis as applied to the Heavens," by William Huggins, F.R.S.
Dr. B. W. Richardson's Lectures, 5 p.m.
Royal Institution, 3 p.m. "Plant Life," by Dr. Masters.

WEDNESDAY, 2nd.

Society of Arts, 8 p.m. "On Tramways in Streets," by W. Bridges Adams, Esq.
Pharmaceutical Society, 8 p.m.
Obstetrical Society, 8 p.m.
Yorkshire Naturalists' Club, 8 p.m. "On the recent Deep Sea Dredgings," by W. Procter, M.D., F.C.S.

FIREDAMP AND CHOKEDAMP.—"B. T." and "R. H."—See our leading article. We dissent from your view of the matter. The dangers are in great bulk due to mechanical causes. Nevertheless, we shall in a spirit of fairness be most happy to insert your letter.

BRITISH ASSOCIATION AND SEWAGE.—"G." is thanked. He will see how we have dealt with the matter.

EUNUCHS AMONG ANIMALS.—"R. H. M."—The letter appears. We have had several others quite confirmatory of the facts expressed in the first communication on the subject.

THE PLANET JUPITER.—"W. F. D."—Many thanks. Should the occasion arise, we shall communicate with you. The note in question reached us safely, and appears.

THE SUN'S SHADOW PATH.—"J. C."—We are much obliged. Reached us just in time. The person referred to is improving.

VOLCANO-FISH.—"G. P. S." is thanked for his interesting communication. We quite agree with him as to the phenomenon and views. The sensational is always more attractive than the mere sober fact. It is extraordinary in these days of scientific training, what a substratum of nonsense pervades the writings of some of our instructors.

NEWCASTLE PHILOSOPHICAL SOCIETY.—"T. P. B."—We regret that pressure on our columns prevents the insertion of the paper. The correction is therefore unneeded.

BULLETIN DE L'ACADÉMIE DE ST. PÉTERSBOURG.—M. L. Voss is heartily thanked. The numbers have not, however, yet reached us.

HAZE AND DUST.—"C. J. R." Your friend's letter is not suited to our pages. The idea of the dust being decomposed air is terribly absurd. It consists of a few organized germs, and of the *débris* of the objects which ordinarily surround us.

NEWCASTLE CHEMICAL SOCIETY.—"A. F. M."—We have received the three reports. We need not say that it would be impossible to reproduce them all. Could you not send us each report as it appears in proof, and by striking out unimportant parts, thus supply us with a readable and useful abstract? The difficulty is very great when thrown on editorial shoulders.

HEMIPTEROUS INSECTS.—Try the volume in the Ray Society's works, published a few years ago. If not successful, consult the secretary of the Entomological Society of London.

METEOROLOGY OF THE MONTH.—"F. B. F."—Thanks for the explanation kindly sent.

MISTAKES IN REPORTS.—"J. R. G."—The errors are not ours. We cannot be responsible for them. The names should have been as you say.

STAINING TISSUES.—"M. J."—Yes. The Poncean is a very excellent medium for the purpose.

NOTICES.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

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THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, MARCH 2, 1870.

THE SCHOOL OF MINES AND THE NEW BILL.

THE geological institution in Jermyn-street, which is variously known as the "School of Mines" and the "Government School of Science," was, we believe, originally established in the reign, if we may so speak, of Sir H. de la Beche. At all events, be that as it may, it is now, after some years existence, under the direction of Sir Roderick Murchison, and is, in some respects, if not in all, a flourishing school. It is maintained by considerable grants from the State, and it, so far as it has been able, has justified the expenditure that has been made upon it. So far as the ability and industry of its staff are concerned, the Government School of Science—which we believe has the misfortune to be, in some way or other, connected with the Science and Art Department—is behind no other place of the kind in the kingdom. Its museum, though not of extravagant size, is well-arranged and exquisitely lighted, and it contains some very valuable type collections, both mineralogical and palæontological. Further, it has a number of Professors, whose names alone are guarantees of the great value and importance of their services, and who, we regret to add *en passant*, are very insufficiently paid for the arduous nature of their duties. So far, everything that can be said of the Jermyn-street school is most favourable.

But, it will be asked by those who so strongly insist on national as distinguished from State education, is such a school wanted? and, if so, what has it done to establish its *raison d'être?* We shall not pause to take up the question as to whether the State or the nation should provide for scientific instruction. The problem is a difficult one, one which it would take too long just now to discuss, and one, moreover, on which we have often expressed our opinion. But, assuming that scientific instruction is valuable to the country, and that the fact is not yet adequately recognized by the masses of the people to induce them to support scientific institutions, and that, for this reason, Government lends its aid to establishments like that in Jermyn-street, there is still a query to answer. What has this School done to justify its existence, to compensate the State for its cost? What good has it achieved *en revanche* for the money laid out upon it?

We are sorely afraid that, if such a question were put by some reforming member of the House of Commons, the reply of the authorities would be considered unsatisfactory. It would be thought, at least, as all things are relative, that with a population like ours, where one in about every twenty-five is reduced to pauperism and destitution, a "Government School of Science," the results of whose labours were so small as those of Jermyn-street, is too much of a luxury. Would not so economic a Chancellor of the Exchequer as the Right Hon. Robert Lowe be of this way of thinking? Indeed, we fancy that if such a question were gravely put, and that the venerable Director of the School of Mines was compelled to come forward with the talents still concealed in the napkin, our reformed Parliament would be apt to refer to the old parable of the axe and the tree. Why do we think thus? We think so because we are aware that the attendance on the ordinary lectures delivered at the School in Jermyn-street is so miserably small, when taken over any number of years, as almost to warrant the absolute abolition of the several chairs. We shall be very glad if those who have the conduct of this institution can show us that we are misinformed; for we are the very last in the world who would discountenance State support for Science. But if it be true, as we apprehend it is, that the classes at Jermyn-street are sometimes so minute that they might almost be counted on one's fingers, then indeed it must be admitted that, under the existing plan, the lectures are practically, and in proportion to the outlay, a decided failure. We beg our readers to bear in mind that we by no means urge that the Institution itself is not one which should be maintained almost in its integrity; what we mean to convey is that, if the attendance on lectures is as small as we have represented it to be, then do these lectures cause an expenditure of time, money, and brains totally disproportionate to the good results they bring about.

Having for some time weighed this question well in our minds, it has occurred to us that the proposed legislation for mines and miners, on which we last week commented, offers us at once a solution of the difficulty which an inquiry into the present condition of the Jermyn-street School naturally suggests. The idea has occurred to us, Why not make the School of Mines, as it is sometimes though incorrectly styled, worthy of its name? Why not make this institution the centre of a series of schools, in which the miners might be taught, both scientifically and practically, the nature of their work and the means of preventing those terrible calamities to which they now seem so liable. It is, of course, right that this school should recognize and examine the palæontology of the country. But it should do more than this; and though we are quite aware that in regard to mining statistics it has performed good work, we have no doubt that if it were put to such an application as that we have suggested, it would not only be prosperous and successful as an institution for teaching, but it would confer inconceivable benefits on the country at large.

The change that we have proposed is by no means a revolutionary one. It is an alteration that could be effected by the addition of one or two Professorships to those now existing, and by some trivial alterations in the present curriculum. But it is a reform which can only be accomplished by much energy and perseverance; and the time is now at hand when the effort may be made. If anything is to be done, it must be done in connection with Mr. Bruce's Bill, and we are informed that it is intended to bring the matter forward when the House goes into Committee on this Bill. We believe that the matter is even now being considered by very able mining authorities, and there is reason for thinking that from these deliberations some wise measure will issue.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

AT the last meeting of the Geological Society, Professor Huxley, the President, delivered the anniversary address. As we published the address for 1868 in these pages, it may have appeared strange to our readers that we adopted a different course on the present occasion. The reason, however, is easily given, and is, so far as we are concerned, a satisfactory one. We have always understood it to be a bye-law of the Society that none of its papers or addresses should appear in print till they have first been published in the journal of the Society, and we believe that this rule has been very stringently carried out for some years. Professor Huxley's address in 1868 was exceptional, because, as we apprehend, it was first printed by the author. It was owing to this circumstance that we were enabled to lay it before our readers prior to its issue in the *Quarterly Journal of the Geological Society*. The address for the current year, however,

fell within the ordinary rule, and being of considerable length is, we believe we are correct in stating, to be printed by the Society. Under these circumstances, a desire to treat the Society with that courtesy and consideration which we have ever received at the hands of its secretaries and assistant secretaries, suggested the impropriety of our sending a reporter to the anniversary meeting to obtain *per nefas* that which *per fas* was unattainable. What the result has been some of our readers are possibly aware. We can only hope that "Virtue is its own reward!"

The *Journal of the Society of Arts*, which has lately much increased in interest, informs us that the Acclimatation Society of Paris has awarded to Mr. P. L. Simmonds its silver medal, of the first class, for his paper on "Silk Cultivation and Supply," read before the Indian Conference of this Society last year. A silver medal has been awarded to Mr. G. W. Hart, of Hayling Island, for his labours in oyster-culture.

An improved process for the extraction of copper from its ores has been patented by Dr. T. Sterry Hunt, F.R.S., and Mr. James Douglas, jun. For the extraction of copper by this process it must be in the state of oxide, or some compound thereof. The oxidized copper is decomposed under proper conditions by protochloride of iron, with the production of dichloride of copper, which is soluble in certain saline solutions, and in some cases a portion of protochloride of copper, with certain salts of iron, which may be rendered soluble by the action of sulphurous acid.

It is an *on dit* that we are to have an International Geographical Congress this year at Antwerp.

Our physiological readers are familiar with a curious apparatus for estimating the force of the blood moving in the arteries, and called the Hæmadynamometer. We regret to state that the inventor of this instrument, M. Poisseuille, has died at Paris, at the age of 73.

The following is the list of the officers proposed to be elected by the Chemical Society at its meeting on the 30th inst.:—President—A. W. Williamson, Ph.D., F.R.S. Vice-Presidents who have filled the office of President—Sir B. C. Brodie, F.R.S.; Warren De la Rue, Ph.D. F.R.S.; A. W. Hofmann, D.C.L., F.R.S.; W. A. Miller, M.D., D.C.L., V.P.R.S.; Lyon Playfair, M.P., Ph.D., C.B., F.R.S.; Colonel P. Yorke, F.R.S. Vice-Presidents—E. Frankland, Ph.D., F.R.S.; J. H Gilbert, Ph.D., F.R.S.; A. Matthiessen, Ph.D., F.R.S.; H. M. Noad, Ph.D., F.R.S.; W. Odling, M.B., F.R.S.; T. Redwood, Ph.D. Secretaries—A. Vernon Harcourt, M.A., F.R.S.; W. H. Perkin, F.R.S. Foreign Secretary—H. Müller, Ph.D., F.R.S. Treasurer—F. A. Abel, F.R.S. Other Members of Council—E. Atkinson, Ph.D.; H. Bassett; E. T. Chapman; David Forbes, F.R.S.; F. Field, F.R.S.; Dr. M. Holzmann; E. J. Mills, D.Sc.; W. J. Russell, Ph.D.; Maxwell Simpson, Ph.D., F.R.S.; R. Angus Smith, Ph.D., F.R.S.; A. Voelcker, Ph.D.

Anti-tobacco-smokers should rejoice to think that there is in France a flourishing association for the prevention of the abuse of the "weed." In its annual sitting, on the 19th ult., the Association Française contre l'Abus du Tabac distributed a number of prizes to the writers of successful essays expressive of the Society's views, and to others who have assisted in suppressing the strange custom which James I. so strongly deprecated in his *Counter-blaste*. The following are a few of the awards:—To Dr. Antoine Blatin the Blatin (!) prize, a silver medal, for his work entitled *Recherches physiologiques et cliniques sur la Nicotine et le Tabac;* to Professor Lefèvre, of Louvain, the Decroix prize, a silver medal, for his memoir entitled *Nouvelles Recherches sur le Tabac, et spécialement de l'Action du Tabac dans ses rapports avec la Folie paralytique;* to M. Désiré, Directeur de l'École des Carrières d'Angers, for his zeal in discouraging his pupils from indulging in the practice of tobacco-smoking; to the professional school of the printers of M. Chaix's printing-office the Chaix medal, on account of the number of apprentices who have left off the habit of smoking. Three or four other medals were somewhat similarly awarded.

We regret to announce the death of M. Florent Prevost, *aide naturaliste* in the Paris Muséum d'Histoire naturelle. His chief investigations related to the subject of agricultural zoology. He had reached the ripe age of seventy-six years.

The Social Science Association is making an effort to spread a knowledge of Political Economy among the public. A course of lectures on subjects connected with Economic Science, especially as concerned with labour and capital, under the auspices of this Association, will be delivered (by the kind permission of the Council) in the house of the Society of Arts, John-street, Adelphi, on successive Tuesday evenings, at eight o'clock. The first lecture was delivered yesterday by W. B. Hodgson, Esq., LL.D., on "The True Scope of Economic Science;" the Right Hon. Sir Stafford H. Northcote, Bart., M.P., in the chair. The second lecture will be delivered on Tuesday, March 8th, by Frederic Hill, Esq, on "The Identity of the Interests of Employers and Workpeople." Admission to these lectures will be free by ticket, which may be obtained at the office of the Association.

At the present moment the science of statistics becomes of especial interest as applied to the condition of Ireland. We therefore reproduce the following abstract of the Agricultural statistics of Ireland for 1869, which have just been published by the authorities. The 4,000 enumerators, selected from the Royal Irish Constabulary and Metropolitan Police Force, have furnished returns of tillage and live stock on nearly 600,000 separate holdings. The total area under all crops in 1869 was 5,575,843 acres, showing an increase in the extent under crops of 27,872 acres. Wheat decreased by 4,033 acres, oats by 16,857 acres, and beans and peas by 3 acres. Barley increased by 34,591 acres, and bere and rye by 1,293 acres. Potatoes increased by 7,156 acres, turnips by 1,786, mangel and beet-root by 2,018, and vetches and rape by 2,355 acres. Cabbage decreased by 736 acres, carrots, parsnips, and other green crops by 58 acres, and meadow and clover by 22,335 acres. Flax increased by 22,695 acres.

The new classes for girls at Cambridge have proved a decided success, upwards of fifty daughters of local tradesmen having availed themselves of the new scheme.

The second course of Cantor Lectures of the Society of Arts for the present session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at eight o'clock. The following is the syllabus:—1. Nature of combustion; effects; different modes of combustion; conditions under which it takes place; evolution of heat and light attending combustion; quantitative relation of the phenomena of combustion; measurement of quantities of heat; temperature; quantity and intensity of heat. 2. Use of fuel for domestic purposes; as a source of motive power; for industrial operations not requiring intense heat, distillation, evaporation, &c., and for producing cold; varieties of fuel. 3. Use of fuel for producing very high temperatures in metallurgy, and in the working of metals, glass-making, and other industrial arts; waste gases of smithery furnaces; means of arresting combustion; extinction of fires. 4. Use of combustible materials for producing light; varieties of illuminating materials, coal-gas, petroleum, and paraffin-oil; measurement of light; photometry.

Dynamite is at last, we believe, likely to become a familiar explosive compound. It is said that the Home Secretary fully approves of its introduction into English mining operations. He has given notice of his intention to issue a general

license for its carriage, storage, and use in mines and quarries. In this respect, says the *Mining Journal*, he is following in the steps of the Austrian Government, who originally prohibited the carriage of dynamite by railway, but, after numerous experiments, and a most searching investigation, issued an order candidly acknowledging that they had been mistaken in believing that dynamite was dangerous to carry, and having clearly ascertained that it might be carried with perfect safety, they authorized its free carriage on the State railways. Of the power as well as the safety of dynamite there can be no doubt. A large mass of iron, consisting of about 150 tons of solid metal, which had accumulated at the bottom of one of the Wigan Coal and Iron Company's blast-furnaces, near Wigan, was completely broken up with great ease with dynamite, about a fortnight since. Attempts had been previously made with gunpowder, and one bore-hole had been fired fifteen times without any effect being produced, but it yielded at once to the superior force of dynamite. This is the second mass of iron of the kind which has been broken up with dynamite at the Wigan Coal and Iron Company's works. Dynamite is now so extensively used on the Continent that Messrs. Nobel & Co., the chief manufacturers, cannot supply the demand, and are obliged greatly to increase their works at Hamburg. One of the great advantages in point of safety of dynamite is that if set fire to it will burn in any quantity without exploding. The fearful explosion of the magazine which has just resulted in so many deaths at the Morfa Colliery could not have taken place if dynamite had been used instead of gunpowder, for the dynamite, if set fire to by a spark or light, would have burned harmlessly away.

The dignity of Senator has been conferred on Professor Pietro Cipriani, President of the Superior Council of Health of the kingdom of Italy, and of the Medical Section of the Florence Institute.

Of the sixty-one candidates for the post of architect to the Conservative Land Society, Mr. John Ashdown, formerly surveyor to the Hammersmith Bridge Company, was the successful one.

Mr. Forster's Education Bill is just printed, and covers 26 pages, and contains 88 clauses.

The first conversazione of the Royal Society will be given by General Sabine at Burlington House on Saturday next. We understand that the display of scientific apparatus will be more than usually interesting.

There is still hope of the foundation of a Royal Society of Medicine through amalgamation of the existing leading medical societies. The original scheme of sections was carried at the last meeting by a large majority.

The French geographers have recognized M. de Lesseps. We learn from the *Builder* that at the general meeting of the French Geographical Society just held, M. Barbié du Bocage, reporter of the committee to award the Empress's Grand Prize of 10,000f., given this year for the first time, announced that the award of that body had been in favour of M. Ferdinand de Lesseps, who, by cutting through the Isthmus of Suez, had accomplished the work most useful to the commercial relations of France. M. de Lesseps received from the president the medal which accompanies the prize, and announced that he would devote the sum of money to the expedition which the society is about to undertake into Central Africa.

The *Melbourne Argus* states that Professor Halford is about to receive a practical recognition of the general opinion of the value of the ammonia treatment of snake-bites. A meeting, at which many members of the medical profession were present, has been held, and a committee has been formed to procure funds for a substantial presentation. We cannot help thinking that, in the face of the important and precise experiments of Dr. Fayrer, of Calcutta, which tend to conclusions opposite to those of Dr. Halford, this movement on the part of the Melbourne doctors is premature.

The Annual Report of the Council of the Photographic Society of London is most encouraging. In presenting their report of the progress made during the past year in all branches of photography, and in referring particularly to the subjects of interest which have come within the range of the Society's formal recognition in the shape of proceedings, the Council consider that there is much room for congratulation. The meetings have throughout been well attended, a most successful exhibition held, and an increased number of members gathered to the Society's ranks.

Sir Digby Wyatt, who is now Slade Professor of Architecture in Cambridge, will commence his course of thirteen lectures on this day week. The following is the programme:—1, Introductory, March 9th; 2, Architecture, History, March 14th; 3, ditto, Theory, March 15th; 4, ditto, Practice, March 16th; 5, Sculpture, History, March 28th; 6, ditto, Theory, March 29th; 7, ditto, Practice, March 30th; 8, Painting, History, May 2nd; 9, ditto, Theory, May 3rd; 10, ditto, Practice, May 4th; 11, Art applied to Industry, Ancient, May 20th; 12, ditto, Modern, May 21st; 13, Facilities at Cambridge for the Study of the Fine Arts, May 23rd. The lectures will be delivered in the Fitzwilliam Museum at 2.15 p.m., with the exception of the introductory lecture, which will be delivered in the Senate-house at 2.30 p.m.

What are bifacial photographic medallions? They are a new form of "photo" devised by Mr. Hemery, and which are likely to become popular among the "engaged" and "young couple" members of the community. They consist of two profiles, one being placed a little in advance of the other. The specimens already issued are good.

The Queen's University, through Sir Dominic Corrigan, is about to ask the Medical Council to stay operations in regard to medical education till it (the University) has petitioned Parliament for a Royal Commission. We quite concur in the proposal of the Queen's University, and we are glad to see it taking such active measures.

There is a meteorological and magnetical observatory at Coimbra (Portugal) which, says the *Athenæum*, has been quietly working for some years. In certain instances the results have been printed in the *Proceedings* of the Royal Society; but the Observatory has now published a thin quarto containing *Resumos Annuaes das Observaçôes Meteorologicas* for 1864-1866 inclusive, with diagrams in which the various facts observed are represented by curves. Apart from their intrinsic value, these results will be useful to observers in other parts of the world who wish to institute weather comparisons.

The Natural History Society of Folkestone have just issued a list of the Butterflies and Moths of the neighbourhood, by Dr. H. G. Knaggs.

Dr. Letheby occasionally gives us some startling opinions, and we think the conclusion just arrived at in a recent report is one which must be received *cum grano salis*. The *British Medical Journal*, in its abstract of Dr. Letheby's views, says that he considers moderately hard water better suited for drinking than that which is very soft—an opinion which is confirmed by that of the French authorities, who took the Paris water from chalk districts instead of from sandy strata. To this we do not object, but the statements that a larger percentage of French conscripts are rejected from soft-water districts than from neighbourhoods supplied with hard water, and that English towns supplied with water of more than ten degrees of hardness have a mortality of four per one thousand less than those whose inhabitants use soft-water, are serious if they are to be considered as associated with the doctor's theory.

Mr. James Britten, writing in *Science-Gossip* for this month, informs us that Mr. J. W. N. Keys is publishing a

Flora of Devon and Cornwall in the *Transactions* of the Plymouth Institution and Devon and Cornwall Natural History Society. It is at present published as far as *Scrophulariaceæ*.

Those who have been recently in the drive by the Serpentine will have wondered at the dried up and railway-cutting-like aspect of the pretty artificial lake. The explanation is that Mr. Fowler is cleaning the Serpentine. This is his plan:—First to draw off all the water, which has been done some time; next to allow the mud to consolidate by exposure to the atmosphere, and this, in spite of the wet winter, it is very rapidly doing; then about 120,000 tons of the surface mud is to be removed till the firm mud beneath is reached, when the whole is to be covered over with a coating about 2 ft. deep of a mixture of stiff clay and gravel. This mixture is almost perfectly impervious to water, and possesses the advantage over concrete that it does not encourage the growth of weeds, as the lime in the concrete most certainly does. These may be said to be the main features of Mr. Fowler's plan, but there are other details connected with it of interest to the public. Thus the whole space to the end of the lake, west of the pretty bridge, is to be so filled in as to give it an average depth of 4 ft. 10 in.—that is to say, about 4 ft. 6 in. at the sides, and 5 ft. in the middle. Over this part, therefore, skaters and sliders may venture with impunity from all risk but that of a ducking. East of the bridge the water will be much deeper, sloping from 8 ft. near the bridge to 14 ft. at what is proposed to be its outfall. The great expense of carting away the mud has been got rid of in a very simple manner. Within about 300 yards of the edge of the large lake "spoil" holes are dug of considerable extent and some 5 ft. deep. A railway is constructed leading from the lake to these extensive pits, and on this run the waggons laden with mud.

The first number of the new series of the *Illustration Horticole*, now edited by M. E. André, is issued. It opens, says the *Gardeners' Chronicle*, with a graceful tribute to the services of its former editor, M. Lemaire.

The late Secretary to the Royal Agricultural Society of England has been appointed Under-secretary of the Inner Temple.

Dr. E. W. Davy has been elected to the Professorship of Medical Jurisprudence in the College of Surgeons of Ireland, vacant by Professor Geoghegan's death. He had been Lecturer in the Carmichael School, and will still retain one of the Chemical Chairs in the Royal College of Science.

The first *Report* of the Royal Sanitary Commissioners is not very satisfactory. It contains the evidence of seventy witnesses, but gives no conclusions, as the inquiry is still going on.

There does not appear to be very good feeling between some of the Professors in Trinity College, Dublin. At a recent meeting, held in the School of Physic, it was proposed "That an address and a suitable testimonial be presented by the students, past and present, of the School of Physic, to Dr. B. M'Dowel, on the occasion of the termination of his clinical connection with Sir Patrick Dun's Hospital." On the other hand, Professor Haughton writes to the *British Medical Journal* that such addresses are forbidden by the laws of the College.

Apropos of the horribly unscientific method of repairing roads adopted in London, Sir Roderick Murchison, writing from Belgrave-square, has addressed the following sensible and humorous remarks to the *Times*:—"As one of the oldest inhabitants of this square, I beg you to lend your powerful aid in assisting my neighbours and myself in modifying a nuisance of which we seriously complain. The present method of keeping up the roadway is very simple. At various periods of the year numerous cartloads of rough, unbroken flints are poured out, and, being equably spread over the whole surface, are then left to be ground down by the action of light carriage wheels and the feet of horses, few heavy waggons and no omnibuses passing this way. From my almost constant residence I am enabled to testify that this nuisance is often inflicted when the road is perfectly smooth, and when the most delicate lady could not complain of a jolt in her carriage. The frequent conversion of our square into this peculiar quarry of chalk flints has resulted in the fact that the central part of the road is already much higher than its sides; and, therefore, in the absence of any other explanation, I am left to suppose that the parochial or public operator who has produced this phenomenon is determined to convince an old geologist like myself what a wonderful amount of denudation can be produced by the diurnal friction of comparatively small bodies, and the occasional descent of water from that central elevation which he himself has created in our roadway."

Mr. Max Müller continues his Lectures at the Royal Institution on the "Science of Religion."

Mr. P. H. Gosse having written to the *Times* describing the frost of Torquay, Mr. E. Vivian writes in explanation to say that Mr. Gosse "gives a somewhat incorrect impression of our winter climate. Sandhurst, where his observations were taken, is in the parish of St. Mary Church, beyond the limits of the small peninsula upon which Torquay is situated; it is on a very elevated position, and has none of the peculiar advantages which constitute the Torquay climate." The lowest degree of temperature which Mr. Vivian has registered at Woodfield, about 150 ft. above the sea and in a north exposure, was 26°, or four degrees of frost less than at St. Mary Church. He has olives and camellias quite uninjured by frost, the latter coming into fine bloom; myrtle and several varieties of acacia and mimosa are only slightly touched. Veronicas, fuchsias, and other half-hardy plants have all survived. North-east is the only wind which brings the climate of the midland counties into the far west; it was severely felt as far as Penzance.

We are informed that the Suez Canal has undergone recent important improvements. From all that can be learnt, it appears that the rock which impeded the passage for large ships at Serapeum has been blasted to a depth of 30 ft., and the broken pieces of rock, some in huge masses, are being brought up by the dredges, of which there are still six at work. These machines were intended only to dredge sand and mud, but are doing the extraordinary work set them in a very effective manner.

The first of the Gulstonian lectures for the present year will be delivered at the Royal College of Physicians, on the 11th of March, by Dr. Maudsley. His subject will be the "Relations between Body and Mind, and between Mental and other Nervous Disorders." They will appear in the *Lancet*.

Helios is the title of a new journal which has just been started as the organ of the Dresden Photographic Society which was formed in October last. It is edited by the chairman of the society, Herr Hermann Krone, who has contributed largely to the first number.

Mr. F. Howlett, F.R.A.S., calls the attention of astronomers to the remarkable character of the solar-spot phenomena now visible in the sun.

At a recent meeting of the Council of the Royal College of Surgeons it was decided to allow meetings of the Fellows and Members within the walls of the College, and immediate advantage has been taken of this resolution in the presentation of the following requisition to the President of the College, Mr. Edward Cock, signed by upwards of 250 Fellows and Members:—"Sir,—We, the undersigned Fellows and Members of the Royal College of Surgeons of England, request that you will forthwith summon a meeting of the Fellows and Members of the College, to discuss and consider the present position of the College with respect to probable legislation and the formation of a single examining board for each division of the United

Kingdom. It will be seen that the surgical profession generally is showing due interest not only in matters which directly affect its own College, but in a question which is of great importance to the profession generally."

THE four surgeons engaged in watching the Welsh fasting girl have been prosecuted.

NOTICE has been given that at the annual election of Fellows at Trinity College, Cambridge, to be held in October next, one Fellowship will be given for proficiency in the natural sciences. The examination will be held in the latter half of the month of September.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

THE TERRACES OF NORWAY.

BY PROFESSOR KJERULF, OF CHRISTIANIA.

IN THREE PARTS.—PART II.

THE steps of the water-courses are directly connected with the question of upheaval. I consider it important to define these steps and terraces more precisely as to their marine or fresh-water origin, since, were we to consider all kinds of clay, gravel, and sand forming the stratified drifts of the English geologists as marine, whether they be situated high above the altitude where marine remains are at present found, or under that height, we should fall into most serious error.

Here comes the question of the computation of time. If it can be maintained that Scandinavia, or a portion of it, is slowly rising from the ocean, it is reasonable to employ such numbers in computing the rising of past times as can be made out as data for the present upheaval. Again we are led back to the glacial epoch; and, as it becomes more and more probable that remains of human existence may also be traced back to the same period, the computation of time will be of particular interest even to non-geologists.

Relying upon the supposed rising at the North Cape, Sir Charles Lyell has put forth, as a probable average, that the rising of the country corresponds to the rate of 2·5 ft. in a century. Measured by this standard, the former position of the sea-level, 600 ft. (Norwegian) above the present time, would have occurred 24,000 years since. One would think this a fair estimate for modern geology, but it is not near sufficient. Lyell, making his estimate of Scandinavian upheaval the starting-point, goes on to take a survey of the condition of other countries, and lastly applies it to England and Wales.[1] And, as the drifting iceberg theory requires, he further doubles the movement, supposes an entire subsidence and emergence, and thereby obtains a period of 244,000 years, which ought to correspond to the altitude in which stratified drift has been found in those countries. Also, if we carry out this mode of calculation with respect to Scandinavia, adopting Lyell's theory of the sea level, which he places at 6,000 ft. difference from that existing, we first have the 24,000 years multiplied by 10 = 240,000 years; and then, by doubling the movement, first subsiding then rising again, 480,000 years.

But at the commencement of this portion of the argument is a point which geologists have relied upon as firmly established, but which is, in truth, the weakest and least well supported in the whole calculations—the assumption that the rate of emergence has always been the same. Whereas every Norwegian valley, the coast, and the mouths of the valleys, abound in evidence showing that this rate has *not* always been uniform, and the steps of the watercourses constitute this very evidence.[2]

Some portion of this immense lapse of time we can at once cut down. Norway cannot be shown to have been 6,000 ft. lower in sea-level during the glacial epoch. The land has not slowly risen 6,000, but rather 600 ft. Therefore we are at once reduced to 24,000 years, and then comes the question as to uniformity of rate of motion.

Let us consider what our terraces or watercourses tell us as to this.

Undoubtedly many and various co-operating causes exist that cause rivers to heap up materials at levels higher than their bottoms, or than the level of their outflow. The American geologist Dana recounts in his *Geology* various possible causes of terrace-formation under the general conditions of rivers, without the help of upheaval or subsidence. It may even be foreseen that some one will prove, upon paper, that the Norwegian terraces are, as a rule, not connected with the rising of the land, but that they belong to the conditions of rivers generally. Yet I will not dwell upon this; the marine origin of our terraces has hitherto met with universal admission.

It is evident that if, in a great number of watercourses, north, south, and west of the mountains, and therefore in both long and short valleys, we are able to prove, from various premises, that a particular step or terrace, almost identical in all situations, is the highest ancient mark of the sea-level, or, as the geologist would express it, the marine boundary, then we also establish that, so far as this step is concerned, the terrace-formation depends upon the old water-level.

Such a step is in fact evidenced in a great number of our valleys. We have, therefore, a reliable determination of a starting-point, and may now look about us for an explanation of all terraces lying above or below that step.

It must be plain to every one that a sea surface is not necessary to account for every step. We are not even at all entitled, nor have we occasion, to think of the sea-level as an explanation of the more elevated steps, so long as we are able to point out other causes. I have already mentioned that the steps lying above the most remarkable one can almost always be attributed to dams and other obstructions. The case is, however, different as regards terraces lying below the step we speak of. Here we have no other cause to show than the sinking water-level itself; for those terraces lie entirely open to the mouth of the valley, and are unsupported by dam or obstruction of any kind.

A wide terrace seems, indeed, in every case to indicate the position of the former water-level. Materials cannot be heaped up in a broad elevated situation except in a basin, whether it be an inland lake or a bay of the sea. Various terraces have early come under observation in Finmark,[3] and have been

[1] *Antiquity of Man*. Second Edition. London, 1863. Chap. xiv. p. 285.

[2] For the benefit of those who always desire to attribute every newly-observed fact to long-known truth, I must not omit to refer to Professor Keilhau's essay "On the Rising of the Land," *New Magazine of the Science of Nature*, vol. i. p. 253. There the author states that the old beach-marks lying at different altitudes testify to changes of level having extended over a long period, alternating with epochs of entire quiet. Also Bravais (*Comptes Rendus*, x. 391, and xv. 817), who follows up this excellent essay on the rising of the land, declares, as the result of his celebrated survey of the old beach-marks in Finmark, that Norway has risen *comme par saccades*, by which he tries to show that the motion of upheaval has been of an undulatory nature, accompanied with burstings. Keilhau concludes, from the "accumulations of modern times, which increase slowly," and from the circumstance that there is no reason for supposing these accumulations progressed more rapidly in former times, "that a very long time must since have elapsed." Keilhau is, as is well known, an opponent of the glacial theory. But it has now been proved that the country was covered with inland ice. This ice has once been melted, and it is not yet demonstrated that this took an immense period. On the contrary, it cannot be denied that a single inundation can do many quiet hours' work during this period of melting. There is, therefore, good reason to suppose that the accumulations formerly progressed with greater rapidity.

[3] Bravais says that the terraces are situated at the mouths of the larger valleys, and represent the ancient deltas of the watercourses. From the observations of Bravais one does not, however, arrive at clear conceptions of the significance of the terraces with regard to the question of upheaval, as one cannot trace the steps along the valleys. The corresponding steps in different valleys are in some situated near the shore, in others further inland. But by connecting the steps nearest to the coast with a former coast-line, without considering those further inland, one arrives at too hasty conclusions. The results commonly derived from the observations of Bravais, who resided one year in Finmark, are that the land has risen unequally, more in the interior than at the coast, as the "ancient coast lines," were supposed to slant from the interior towards the sea. It appears, from our investigations, that the highest steps are found farther up in the valley. But we must avoid connecting different steps by any supposed line.

connected with certain marks of erosion upon the rocks, and the marks, treated of together with the "ancient coast-lines," or as terraces "running parallel with the coast-line," &c. This has given rise to the incorrect conception that the terraces were indebted to the sea for their entire formation; and by forgetting the work of the river, the terraces have been connected, when visible at the coast, with a supposititious line. The chief work of the sea at the coast is that of destruction. The sea alone could never form a terrace, as may be plainly seen by any one sailing round the coast of Norway, for he will observe that the whole shores are not surrounded by terraces, but will meet with them at a few places only in those—namely, where a watercourse opens out. The chief work of these latter consists in transporting stones, gravel, and argillaceous mud—materials in general—down to the nearest water-basin. The terrace is formed by the joint labour of the brook, the river, the flood, and the sea.

When a plain, such as that of the newly-formed terrace dries, the flowing waters cut deeper down. During the lapse of time the river meanders in windings, which are subject to change, unless defended by the hand of man. It digs a deep passage through the terrace, the bed becomes more even, an inclined plane, and there are, perhaps, only small traces left of the terrace nearest to the sides of the valley, or where a lateral valley occurs which has brought fresh materials to the main one.

Now, if the sea sank equally and slowly, there is no cause at hand for the formation of high, distinct, regular, and open terraces, one below another. On the contrary, for the formation of a plurality of terraces it is requisite that the sea-level shall remain for some time and then rapidly change—therefore suggesting not a regular, but an irregular or periodical movement.

If the water-level V D (fig. 1) sinks suddenly to *v d*, and then comes to a state of comparative quiet, the terrace T will be laid dry, and the formation of the lower terrace *t* begins at the lower level.

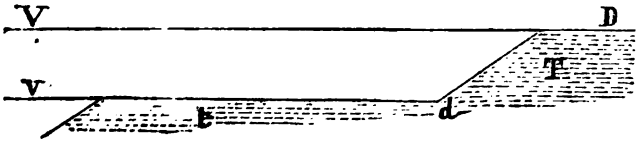


Fig. 1.

If, on the contrary, the water at the level V D sinks gradually and slowly to *v d*, and continues to sink, the materials

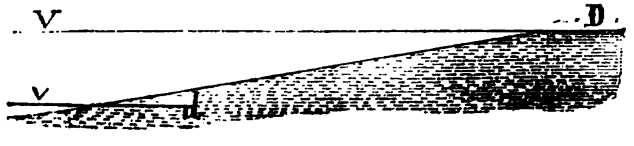


Fig. 2.

of the water-course will be heaped up to the water-level of each year, and high and low tide will affect the detritus at the same time, and a slope will be formed from V D to *v d, but no distinct steps* (fig. 2).

As we do not find the floors of our valleys form an inclined plane from the highest marine terrace to the present sea-level, or to the Oere (tongue of land), but show divers steps between those two boundaries, we may conclude with certainty that the upheaval has not occurred uniformly, but, on the contrary, by fits and starts.

The fact that more open terraces are found in our valleys below the highest ancient beach-mark seems thus to tell us that the motion occurred with several shocks, with intervals of comparatively slow motion, if not of rest.

As the upheaval at each shock was comparatively sudden, it thence follows that it is at present impossible to make any computation of time deserving of confidence.

When we consider the nature and situation of the usual sea-floors, with respect to the terraces in our valleys which are filled with sand or clay, the conviction forces itself upon us that these terraces are the marks of the rivers, which carry down the materials whilst the sea spreads them. The level of the terrace corresponds to the floor and beach-marks of the sea, which follow the position of the sea at high and low water. The sloping side of the terrace corresponds to the inclined plane of the sea bottom, or to the "Maalbakke" or sandbank (quicksand), that well-known dread of all bathers round our islands.

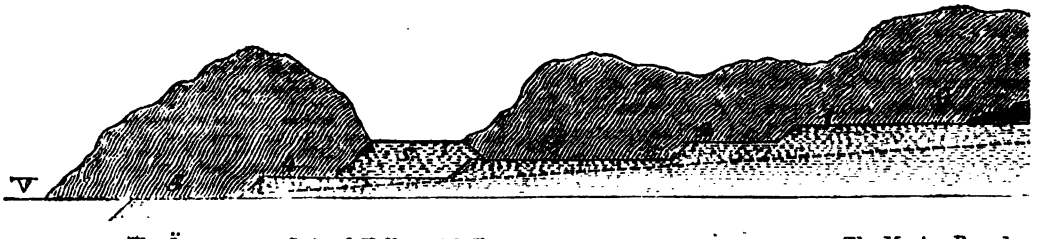
At the Lurdalsöre (the termination öre signifies a flat at the level of the sea in Norsk), Surendalsöre, Orkedalsöre, Stördalsöre, Vaerdalsöre, &c., we have this sea-floor terrace in the water, whilst the first terrace rises higher up in the valley. If the sea-level suddenly became 50–100 ft. lower, a new terrace would appear at those Oerer—namely, the present terrace at the sea-floor. The rivers would subsequently carry sand and clay seawards, and again store up these fresh materials 50-100 ft. lower down, thus forming a new sea-floor terrace. The river would furthermore, in flowing from an increased altitude, dig its winding course deeper through the freshly-exposed terrace; in short, all the circumstances of the different marine steps of the valley bottoms would be repeated.

Here let us remember that the sluggish stream carries down chiefly sand and mud, but the more rapid torrent carries likewise pebbles in vast quantities, when the river has the opportunity of hurrying such material down its course. A layer of worn pebbles is thus the sign of a rapid stream.

But at each sinking of the sea-level during the sudden change we have supposed, the excavating power of the river would increase in the same measure as the vertical measure of its depression increased. In consequence of this, we should expect to find a stratum of pebbles uppermost in the lesser steps and terraces, which the windings of the river have dug out between those larger and broader terraces that owe their existence to the different periods of rest of the sea-level. Nothing is, in fact, more common than to find thick layers of pebbles on the tops and margins of the subordinate terraces described.

I have tried to represent the lowest steps of the water-courses—those produced by the former sea-levels—or the marine terraces in their common appearance, in a figure (fig. 3) showing main valley, with the mountain side in the background.

Fig. 3.—Terraces in a Main Valley.



The Öre. *Lateral Valley with Terrace.* *The Marine Boundary.*

V, the water-level at present sea-line; G, the boundaries of the highest sea positions formerly. 1. First or highest marine terrace; 2, 3, 4, successive lower terraces; 5, the terrace at present in course of formation, or sea-bottom terrace.

On the left is the "öre," with the sea-bottom terrace; on the right, the highest of the ancient sea-level steps, or, as we have called it, the marine boundary. Between these two limits are seen other steps and terraces. At one place the mountain-range is interrupted, for there a lateral valley opens into the main valley, and here again is seen a high terrace, formed by the materials carried down through the lateral valley during one of the higher positions of sea-level. The slanting line from the sea-floor terrace to the marine boundaries shows the bed of the river tending to produce an inclined plane.

For the sake of space, the terraces are drawn in too rapid succession, and, to make them distinct, they are much too high in proportion to length. In reality the surface of a terrace is not quite horizontal, as appears in the drawing, but forms a slight slope, in the same way as the last or sea-floor terrace runs out into a long shoal, till it abruptly falls over the margin of the sandbank farthest out seawards. When the river carried its detritus down to the sea-level, No. 1, those materials had to be transported farther and farther down to a slightly inclined plane, the surface of the terrace. If the action of the river had been long continued, and with plenty of material, during a rest or a very slow change of sea position, a long inclined plane would be formed. The levels of the terrace (which are, in fact, inclined planes) do not, therefore, *everywhere* indicate the ancient water-level, the correct maximum boundaries being indicated by the innermost borders of the terraces.

According to previous explanations, the steep incline at the end of each terrace is the "step" which indicates a sudden rising of the land. The less sloping surface *might* be formed during a slow emergence like that attributed to Scandinavia. In the computation of the length of time the steep portions must be deducted from the entire height, and we have only such elevation left as is indicated by the slightly sloping surfaces, and by these is time to be calculated. How much, then, is to be deducted from the estimate of 24,000 years? Should we attempt, with the data before us, a calculation of time worthy of more confidence, all measures at the outer and inner foot of each terrace must be determined. But there are many circumstances in practice which prevent such precise measurements, and our calculation would scarcely be practicable. This much, however, we see at a glance—the immense length of time will be shortened to an intelligible number of some thousands of years, if there be any truth in our conception as explained above.

In our drawing of the lower course of the valley these terraces are all open, not supported by mountain buttresses or by dams across the valley. To this figure we might add another, plainly tracing the upper course of the valley, and we might depict steps, assigning to each step a special cause, as a compact wall of sand and gravel, a moraine or lock towering above the contracted parts of a valley, &c. But a walk amidst the sublimity of nature would be far more interesting than the multiplication of figures.—*Translated from the Norsk.*

THE FRENCH SYSTEM OF STORM MAPS.

BEHIND, or rather beside, the Pantheon in Paris, at the corner of a street that runs towards the Observatory, at the far end of the Gardens of the Luxembourg, and in the ground floor and corner room, as if it were an American apothecary shop or grocery store, the traveller, curious in such things, will find a woman sitting at the receipt of custom, taking down subscriptions for the daily bulletin of the meteorological observations carried on at the Observatory. I have recently learned, however, that the task of making these observations is now transferred to the new observatory, of which M. St. Claire Deville is the learned and distinguished superintendent,

When we crossed the ocean in October, 1866, from New York to Brest, in the *Ville de Paris*, we knew that the passage would be stormy, for the time of sailing fell on the bad day of the weekly storm system of that year. And so it turned out. We got engaged in the southern rim of a tremendous "north-easter" just departing, like ourselves, from the States for England, and we sailed nine days in its company, sometimes gaining on it, sometimes beaten back by it, until one night, not having seen the sun for six days, we lay to in front of a lighthouse, not knowing where we were, only that we certainly were not where we should have been—off Ushant. When morning broke, the shore appeared. It was the coast of Cornwall. We turned therefore at a right angle, and steamed across the mouth of the English Channel, and arrived at Brest one day later than we should have been had we made Ushant light.

This lost day permitted our disagreeable companion, the north-easter, who seemed utterly indifferent to our society, to go ahead; and then the sun came forth, and the beautiful and curious cliffs and monuments of Brittany, and the rare scenery of the port of Brest, remunerated us for the delay.

Had we been on a voyage from Labrador to Norway, we should have been on the northern rim of the storm instead of the southern; and it would have been a south-wester, instead of a north-easter, and have driven us forward, all the way, *pèle mèle.*

I was so curious to follow the subsequent course of this erratic monster, that on my arrival in Paris, I subscribed to the Meteorological Bulletin, and got the back numbers for two weeks.

Looking on the chart for the day before we saw the English light—there, sure enough, was the front rim of our storm drawn in curved lines from north to south, and bellying eastward, over the north-west corner of Europe. The next day's chart showed it further advanced and raging into the North Sea; and each successive daily chart marked its position further and further east-south-east, until its form was broken up and lost between the Black and Caspian Seas.

The winter I spent in part at Pau in the Pyrenees, and every morning I had at my breakfast-table the mapped climate of all Europe of the day but one before. And every week I had a new storm to follow, from its first appearance on the west coast of Ireland, to its disappearance three or four days later in the Levant, or across the Ural mountains.

Sometimes there appeared signs of a disturbance in this regular march, which I could not comprehend, and then the order would be resumed and regularity maintained as before.

In St. Petersburg a similar storm map has been published for some years, even better adapted for the student than the French. In England there was until recently a distribution of storm information, in advance of time, to all the seaports of England, by telegraph from Greenwich; but the labour and expense were supposed to be inadequate to the results; the designer of the system, on whom it chiefly depended, became engaged in other scientific pursuits; and the daring fishermen and economical merchants of England were impatient of control. So it has ceased.

Along the stormy and dangerous coasts of the United States such a system would be of incalculable value, and ought to have been established by Government long ago. One wealthy merchant of Boston or New York, however, could by himself keep up an establishment of the kind they have at Paris, until it became self-supporting—and not have to wait long for that to happen. The *Bulletin* of Paris is a quarto sheet of four pages, on the first, second, and third of which are tables of the state of the barometer, thermometer, and sky, the rain-fall and wind-force, at all the places from which telegraphic despatches had arrived that day, and lagging despatches of the day before.

The third page, kept permanently furnished with a map of Europe, printed in blue, shows on this map, but in strong black lines, the curves of barometric pressure, geographically drawn through or near the places from which the telegram of the day has come. These telegrams are studied in the evening, and

thrown into curves, printed over night, and distributed in the morning. In Paris, a man can see at a glance the condition of the atmosphere as it was all over Europe the day before.

The lines of barometric pressure are all concentric in a greater or less degree, because they show the sides of the great waves of air which are rolling forward over the surface of the earth, and pressing unequally on the innumerable barometers of Europe. Each curve is marked 700, 705, 710, 715, &c., meaning millimètres of mercury. In America we should mark them tenths and hundredths of an inch. Arrows also appear on the map, showing the direction and force of the winds.—*Old and New.*

MONSTERS FROM A SCIENTIFIC AND LEGAL ASPECT.

BY T. EDWARDS CLARK, M.D., OF NEW YORK.

THE law is, monsters cannot inherit; but we are not told how much of deviation from the normal human form is sufficient to constitute a monster. Are the Siamese twins monsters? Are they one or two individuals? How great must the union be between two such bodies in order that the term monster may be justly applied to them?

We have reached a period in civilization when men of science enforce their claim to a share in the shaping of the laws; and individual responsibility is no longer determined by the moralist or legislator alone, but the physician and naturalist have a hearing and an influence.

Some recent researches of M. Lereboullet, in regard to the development of the lower animals, have an important bearing on the above questions of individuality and monstrosity. To most readers, no doubt, that rather frequent occurrence, an egg with a double yolk, suggests itself in this connection; and we would here mention that the superintendent of the Madras Museum lately received a boiled fowl's egg which contained a smaller egg *with a shell*. These, as we shall soon see, have no bearing on the above questions, for their double yolks, which are the true eggs, are always distinct from one another, and always produce, not monsters, but two chicks of normal form.

M. Lereboullet, while studying the embryology of the pike, noticed some most highly-interesting facts. Certain eggs, instead of developing a single line or band on the surface as the groundwork of the embryo, showed two of them which produced double fishes, with bodies of equal size, but united behind to a greater or less extent. He observed other eggs in which these bands were united anteriorly, and a single fish with two tails was the result. He also watched the development of fishes having a double body, but only one head and one tail.

But these were not all the strange changes observed in individual eggs. He discovered triple fishes—fishes with three heads, and three more or less fully-developed bodies united posteriorly. And, lastly, we have to mention a remarkable combination, which, no doubt, has considerable bearing on some psychological questions, which have always puzzled those who have made mental science a special study. M. Lereboullet watched the development of some eggs, on the surface of which there at first appeared two transparent, longitudinal, and parallel lines, terminated in front by two cephalic lobes or immature heads, which later approached one another, and finally became so completely united (the contiguous halves of the embryos disappearing) that a fish, normal in all its parts, was the result.

Many variations of these four typical forms were observed; and it must be remembered that the embryonic cell (not a two-yolked egg), which usually produces a single individual pike, was seen occasionally to develop into one with two heads or two tails, or into one whose longitudinal halves belonged originally to two separate but parallel primitive bands.

Now we certainly would consider a pike, developed from a single egg-cell, with two tails (the tail of a fish consists not only of the caudal fin, but also of the posterior portion of the body), as a single individual; but let the other end be doubled, let there be developed from an egg a pike with two heads, and for what reason can we hesitate to call it still a single individual? Is there not here also simply a doubling of some portion of the body?

But, suppose both these conditions to occur, and the bodies to remain more or less intimately connected, have we two individuals? If so, why now any more than before?

The pike is classed among the lowest members of the vertebrate series, yet the earlier stages of its development do not differ essentially from those of the highest members of this grand division of the animal kingdom to which man belongs.

The application which we would make of these discoveries of M. Lereboullet is obvious. Again we ask, Are the Siamese twins monsters? Are they one or two individuals?

As late as 1865 there lived in Seville, Spain, a man named Jean Baptista de los Santos, aged twenty-two years, who had four legs, two of which were closely united, and covered with flesh and skin in such a way as to appear to the superficial observer as a single limb.

We have records of several instances of children living for considerable time having not only three such legs, but also three arms and two heads, their bodies being united throughout their entire lengths.

There are other cases where the union is still more complete; the double arm and leg are not developed, but there are two distinct heads, and the body, which appears to be of the normal type, is in reality formed, as is shown by certain peculiarities, by the growing together of two opposite (not contiguous) halves of different germinal bands. Many cases are reported which show all grades of union of two heads, producing faces with four eyes, two noses, and two mouths; others with three eyes, and still others where the third *compound* eye has disappeared, and the two noses and mouths are more or less closely merged into one nose and one mouth.

Through these last-mentioned cases we reach the highest degree of fusion, and the Siamese twins stand at the other end of the series. The recognition of the duality of the latter is easy, but that of the former is often only established by a careful inspection of the parts near the median line of the body, and of the viscera. Such a person, appearing single, is in reality composed of two individuals, *if* the Siamese twins are to be considered in that light.

It thus seems to be no easy matter to form a legal definition of the term monster when treating of human beings. If we would not call these twins monsters, would we apply the word to a person in whom such a union, positively made out, is carried to its extreme, and who appears single? Is it not certain that both these would escape the law, provided ordinary intelligence were present in each? Moreover, would not all intermediate compound human beings, possessed of sound minds, be entitled to the same consideration?

The fact of a psychological nature to which we have above alluded is this: There are perfectly reliable instances recorded of persons leading a double existence, who seem possessed of two mental or spiritual natures, having no connection whatever with one another, but both manifesting themselves, of course, through the body, and controlling its movements. The power of memory of one mind has no knowledge of that which has been acquired by the other. The two lives alternate with one another; they are more or less natural, and the period of the temporary rule of each is in some instances a constant time, in others variable. Such a person, though leading a double life, is conscious of living only one, and the thread of each is regularly taken up and continued as though there had been no interruption. May not the dual physical nature which we have pointed out as existing in some persons, account for this remarkable mental phenomenon?—*Journal of Psychological Medicine.*

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK,

From February 13th to 26th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
2 Petz's Conures (Conurus petzi)	Mexico	Received in exchange	Parrot-house
1 Arabian Baboon (Cynocephalus hamadryas) ♂	Aden	Presented by H. Duncan, Esq.	Monkey-house
2 European Souslik (Spermophilus citillus)	Europe	Purchased	Small Mammal House
1 Garden Dormouse (Myoxis mitela)	Ditto	Ditto	Ditto
1 Hamster (Cricetus vulgaris)	Ditto	Ditto	Ditto
1 Scarlet Ibis (Ibis rubra)	Para	Deposited by Viscount Hill	Eastern Aviary
1 Banksian Cockatoo (Calyptorhynchus Banksii) ♀	New South Wales	Purchased	Parrot-house
1 Maholi Galago (Galago Maholi) ♀	South Africa	Presented by Lieut. A. J. Hepper, R.E.	Monkey-house
1 Common Camel (Camelus dromedarius) ♂	Egypt	Deposited by Mr. Sanger	Camel-house
1 Hairy-nosed Wombat (Chaeocolomys latifrons)	Victoria, Australia	On approval	Wombat-house
1 Kangaroo (Macropus sp.) ♂	Lake Hope, N. Aust.	Ditto	Kangaroo-sheds
1 Fieldfare (Turdus pilaris)	Europe	Purchased	Western Aviary
1 Bonnet Monkey (Macacus radiatus) ♂	Continental India	Presented by B. L. Cumberland, Esq.	Monkey-house

♂ Male. ♀ Female.

ON AURORAL APPEARANCES AND THEIR CONNECTION WITH THE PHENOMENA OF TERRESTRIAL MAGNETISM.

BY BALFOUR STEWART, F.R.A.S.

SOME years since I ventured to suggest that auroral displays might be secondary currents due to small but rapid changes, caused by some unknown influence in the magnetism of the earth. In developing this idea, the earth was compared to the core of a Ruhmkorff machine, and the moist upper strata of the earth, as well as the upper strata of the atmosphere, to secondary conductors, in which currents will take place whenever the magnetism of the earth changes from any cause. These views would appear to be confirmed by the very interesting records of earth-currents obtained by Mr. Airy at the Greenwich Observatory, in which it is found that during times of great magnetic disturbance there are strong earth-currents alternating from positive to negative, the curves lying nearly equally on both sides of the zero.

A further development of this idea has lately occurred to me, in consequence of a remark of my friend Mr. Lockyer, that the zodiacal light may possibly be a terrestrial phenomenon, and may therefore be somehow connected with the phenomena of terrestrial magnetism. For not only will secondary currents be caused in a stationary conductor in presence of a magnetic core of variable power, but also in a conductor moving across the lines of force of a constant magnet. The question arises, Have we on the earth such moving conductors? In answer to this, let us reflect what takes place at the equator. When once the anti-trades have reached the upper regions of the atmosphere they will become conductors from their tenuity; and as they pass rapidly over the lines of the earth's magnetic force we may expect them to be the vehicles of an electric current, and possibly to be lit up as attenuated gases are when they conduct electricity. May not these form the zodiacal light?

Such moving currents will of course re-act on the magnetism of the earth. We may therefore suppose that somewhat sudden and violent changes are likely to take place in the earth's magnetism at those seasons at which the earth's great wind-currents change most rapidly. May not this account for the excess of disturbances at the equinoxes?

Besides the anti-trades there are also no doubt convection currents, caused by the daily progress of the sun, taking place in the upper regions of the earth's atmosphere. May not these also be the vehicle of currents as they cross the lines of the earth's force, and account, to some extent at least, for the daily variations of terrestrial magnetism? and may not this be the reason of the likeness observed by Mr. Baxendell between the curves denoting the daily progress of the wind and those denoting the variation of the declination magnet? Such currents, in as far as they are electric conductors, taking place in the upper regions of the atmosphere would not be felt by the earth-current wires at Greenwich, and I think Mr. Airy has noticed that this is the case. But the tidal wave represents a motion of a conductor on the earth's surface, with two periods in one lunar day. This motion cannot produce a very great secondary current, but may it not be sufficient to account for the lunar-diurnal magnetic variation, which is also very small?

Such a current taking place in a conductor electrically connected with the earth's upper surface ought to be felt by the Greenwich wires, and, if I am not mistaken, Mr. Airy has detected a current of this nature.

May we not also imagine that there are two varieties of Aurora, one corresponding to stationary conductors under a very rapidly changing core, and the other to rapidly moving conductors under a constant core? And might not an Aurora of the latter kind indicate the approach of a change of weather?

These remarks are thrown out in order to invite comment and criticism, and they will have served their purpose if they direct attention to the part that may be played by moving conductors in the phenomena of terrestrial magnetism. It will be noticed that these remarks do not touch upon the mysterious and interesting connection believed to exist between magnetic disturbances and the frequency of solar spots.

P.S.—Since writing the above, Sir W. Thomson has called my attention to a paper by him in the *Philosophical Magazine* for December, 1851, in which it is suggested that moving conductors may play a part in the phenomena of terrestrial magnetism.—*Paper read before the Royal Astronomical Society.*

ON THE CALCAREOUS SPICULA OF THE GORGONACEÆ, AND THE IMPORTANCE OF THEIR CHARACTERS AS A BASIS FOR GENERIC AND SPECIFIC DIAGNOSIS.

BY W. S. KENT, F.L.S., F.R.M.S.

IN an interesting paper published in this month's *Monthly Microscopical Journal*, Mr. Kent in the first place gives us a brief account of the work that has been already done by other writers relative to the study of the Gorgonaceæ, and in which he refers most particularly to the labours of Quekett, Valenciennes, Milne-Edwards, and Kölliker. The last-named writer, however, appears to be the only one who has recognized the zoological

importance of the characters afforded by the calcareous spicula, the remaining naturalists considering them valueless for any other than specific diagnosis.

The researches of Professor Kölliker, embodied in his monograph, are principally confined to his examination of the type specimens of Esper, Duchassiang, and Michelotti.

Mr. Kent, by the study of spicula prepared from the type specimens of Valenciennes contained in the Paris Museum, and also of the entire organisms and spicula contained in the British Museum and that of the Royal College of Surgeons, in addition to corroborating to a great extent the results arrived at by Professor Kölliker, adds testimony of his own relative to a number of species not alluded to by that writer, and also points out the true zoological affinities of numerous doubtful species of Milne-Edwards, as indicated by the characters of their respective spicula.

Mr. Kent next gives us a brief synopsis of the system of classification now most universally accepted (that of Milne-Edwards) of the order, including the group which forms the subject of his communication, and which, not having been before published in the English language, will be of considerable value to zoologists in general, as well as microscopists. He then proceeds to describe the genera consecutively, adding the results of his investigations relative to the characters of their spicula. These remarks are richly illustrated by two plates, in Tuffen West's best style, containing upwards of ninety distinct forms, and the majority of which are now figured for the first time. These figures are so arranged that the observer catches at a glance the characteristic forms predominant in the respective genera; and reference to the two plates is sufficient to show what an endless and exquisite variety of form these calcareous spicula present, and in addition, what zeal and labour Mr. Kent has bestowed upon the subject.

The facts eliminated by Mr. Kent demonstrate beyond doubt the high importance that must be attached to the modifications of the spicula in our appreciation of the generic characters of the Gorgonaceæ.

In conclusion, Mr. Kent would impress upon zoologists the necessity that greater attention than hitherto ought to be paid to the structural characters of the whole of the Gorgonidæ, and, on the other hand, less to that of mere variation in external form.

He proposes on some future occasion to lay before the Microscopical Society further details regarding the specific varieties of the spicula, and the relative positions of the various forms in relation to the common polypary, and also to demonstrate that throughout their infinite variety one law of uniformity essentially prevails.

ON THE GEOGRAPHICAL DISTRIBUTION OF THE CONIFERÆ.

BY ROBERT BROWN, F.L.S.

THE following general conclusions may be drawn :—

1. Coniferæ are found all over the globe, but they affect cool situations. Whenever a northern species wanders southward of the region where it obtains its maximum of development (such as *Abies Douglasii* to Mexico), it climbs to an elevation where the mean temperature approximates to that in which it is found farther northward, and *vice versâ*.

2. Each species spreads in the direction of the least (α) meteorological change, and (β) physical change. Mountain ranges are, next to meteorological conditions, the most important elements affecting the range of species.

3. Each species has, in all likelihood, an isotherm of its own, and the whole order only prospering within certain limits, these limits not being very wide.

4. Temperature is not so important to the growth of coniferæ as moisture. This is the all-important element in the growth of forests; the great steppes of Asia and prairies of America being almost entirely due to the absence of sufficient moisture for the prosperity of trees. Trees require at least from 15 to 16 in. of rain during the growing season. The dense forests, for instance, of the western slope of the Cascades, are wholly due to the abundant supply of rain that region obtains. Its effect is well seen in the treeless aspect of San Diego, in Southern California, which has an annual rainfall of only 8½ in., while Sitka, in the territory of Alaska, is deluged under the enormous rainfall of nearly 7½ *feet* per annum!

5. Each species has a region where it obtains its maximum of development. Out of this region it decreases in individuals, as well as in the vigour and general appearance of these individuals.

6. Each *natural* genus seems to have been created in the centre, in which the greater number of its species is found. That these centres of creation have undergone many modifications by great geological changes since their original creation there can be but little doubt, and many of these anomalies of the distribution of plants may be thus explained. The question of the origin of these species does not, I conceive, come within the province of this paper. With the modification stated, I consider that I am justified in saying (though with much diffidence, as many illustrious naturalists hold an entirely contrary opinion) that the idea of specific centres is not yet established as a "perfect delusion."[1] When we find a large number of closely allied species of a genus wholly confined to one limited district, we may conclude that these species have originally sprung from some parent type.

7. The range of species is no way, however, limited to systematic classification, species of one genus being found in widely distant localities. There may, however, have been some original connection between these localities.

8. It is most erroneous to say that in every case climate, elevation, &c., do not affect the distribution of plants and animals. Whatever may have been the effect of former geological and physical changes—as exemplified in distributing the Malayan flora and fauna—this is not so in some other parts of the world, such as North-west America, &c.

9. Geological structure of a country has a considerable influence in limiting the distribution of a species—for instance, *Sequoia sempervirens*, is bounded by the metamorphic sandstone of the coast range, and the line of junction between the carboniferous rocks of the Illinois region with the cretaceous and tertiary, is a distinct limitation of many species of trees—by rendering the soil more porous and drier.

Such, in a few words, are a few of the general conclusions I have arrived at as far as I have gone. I beg that they will be received merely as *primitiæ*—a sort of programme of a more extended essay which I may crave permission to lay before the society at another time. I may mention, that since this paper was written, the treatise of Dr. Hildebrand, "Die Verbreitung der Conifern in der Jetztzeit und in den früheren geologischen Perioden,"[2] who also quotes Th. Beinling, *Ueber die geographische Verbreitung der Conifern* has reached me. As both authors appear to treat the subject from a totally different stand-point from mine, I have nothing to remark regarding their elaborate memoirs further than to recommend their general accuracy and the painstaking work displayed in them.—*Transactions of the Botanical Society of Edinburgh.*

Weather Signs.—The following, says the *Farmer*, may be worthy of a corner:—"An old gentleman informed me that he had made it a constant practice for the last fifty years, during the frost, to watch a mole-hill, and had always found that if the mole threw up fresh earth within forty-eight hours the frost would be gone. He was advised to do this by his father."

[1] Bentham: Address to the Linnean Society, May 24, 1869. *Proceedings*, lxxviii.

[2] *Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande und Westphalens.* Zweite Hälfte. Bonn, 1861, p. 199.

GALVANOSCOPIC LANTERN.

BY EDWIN SMITH, M.A.

HAVING occasion to exhibit to an audience some of my recent experiments on the electrical phenomena of plants, I was obliged to invent some means of throwing the image of the index of a sensitive galvanometer upon a screen, I did not want to use the electric light, or to add the weight of even a small mirror to the astatic needles; otherwise a bright spot of light might have been made to indicate the deflections on the plan of a Thompson's galvanometer. After a good many trials of various expedients I hit upon the following, which I found to answer my purpose admirably. It is an application of the principle of the magic lantern, and is at once simple and effective. It requires no stronger light than that afforded by a large belmontine lamp. The hands of the operator, not being wanted for troublesome adjustments of the illumination, are at liberty for the performance of his experiments. The apparatus is also inexpensive. No iron must, of course, enter into its structure. I made mine of wood, with brass screws, only adding a copper chimney to the box which contained the lamp. The light thus inclosed is placed in the focus of a large condensing lens. A circular aperture is left in the lamp-box of the same size as the lens for that purpose. The rays being made parallel by the condenser fall upon a mirror behind, sloped at an angle of 45°, and are thus thrown upwards past the moving index of the galvanometer. This index, formed of the lightest possible stem of grass, is fixed at right angles to the upper needle, and projects horizontally over the lower mirror before mentioned. Just above the index and in the top of the box are placed the front lenses of a magic lantern, which throw divergent rays upon a second mirror, also inclined at a suitable angle, by which they are finally cast upon the white screen. It is best to adjust the lower mirror first with regard to the light, then to adjust the sliding lenses till a distinct black image of the index is obtained stretching across a bright field. The front and the back of this apparatus may be made movable to enable one to get at the interior when necessary. An upright narrow case of cardboard, strengthened by two parallel ends of wood, should be placed so as to contain the arrangements for suspending the needles and prevent gusts of air from disturbing them. Two mercury cups may be drilled behind the box in the thick board which forms its bottom, and which should project beyond the sides, for the purpose of carrying three or four levelling-screws. Every part of the box, inside and outside, must be stained black.

I can strongly recommend the above contrivance to the notice of teachers and lecturers. A popular audience seems to understand the clock-like movements of a black finger upon a screen more readily than the linear motions of a bright spot. The spectators feel as if they saw the needle itself which is being deflected by voltaic currents.—*Chemical News.*

HINTS ON PRESERVING LARVÆ.

BY H. PRYER.

SOME two years ago, seeing some preserved larvæ in the possession of Mr. Bond, I became desirous to know the method by which they were prepared; and, after a good many experiments, I attained success. Believing that there are many others who would like to be informed of the *modus operandi*, I have pleasure in giving them the result of my experience, as follows:—

Having procured a larva, immerse it in a solution of alum or pyroligeneous acid for a short time; then gently squeeze the inside out, upon or between pieces of blotting-paper, taking care not to tear or enlarge the anal orifice. After having extracted all the moisture and intestines, insert in the aperture a bent glass blow-pipe, having a bulb in the middle, and inflate the larva over a spirit-lamp, having a flat piece of zinc fixed over the flame. Holding the tube so that the larva does not touch the zinc plate, blow gently, until it is quite dry and hard. This requires great care, as it is liable to scorch; and, if the skin be only partially dry, it will, although apparently finished, become indented or depressed in those places where it is not thoroughly hardened. To ascertain if the operation be complete, cease blowing, and draw in the breath gently; when, if the larva is not dry, it will shrivel up, and must be inflated again immediately; if, on the other hand, it is dry, it will remain distended to its natural size and appearance. To prevent the head from being extended too much, dry all the body except the first and second segments, take the larva away from the spirit-lamp, and press the head into its natural position, afterwards drying it at some distance from the flame, without blowing through the tube. If the larva require colouring (as almost all green larvæ do), some very finely powdered dry colour (rather darker than the original colour of the larva) must be introduced into the skin after it is thoroughly dry. To get the colour evenly on the inside of the skin, it must be rolled about in the hand. In order to direct the heat on to any particular place, a small hole (about the size of the head of a pin) should be made in the centre of the piece of zinc. This will be found to be particularly useful, when finishing the head of the larva, as above described. The object of having the glass tube bent is that the head is then above the level of the flame; and the bulb is to prevent any moisture from the mouth running down the tube into the inside of the larva. I generally put a piece of blotting-paper in the mouthpiece of the tube.

The inflation while the larva is over the lamp must be kept up without intermission. This is very easy after a little practice, and does not cause any exertion, as the breathing is carried on through the nose.

A larva should be kept without food for a day before being killed, as it is almost impossible to extract the food that it has just eaten; and, after the larva is dried, this shows in an ugly black patch just behind the head.

Very frequently it occurs that, while blowing, the larva will slip off the tube; this can be prevented by tying a thin piece of cotton round the end of the tube and the last pair of claspers. It is, however, as well, if possible, to dispense with tying the larva on the tube, as it very often distorts the shape of the last segments.

The best larva for a first experiment is one that has no bright colours and is not hairy; such as *Noctua xanthographa.*

The reason for putting the larva in pyroligneous acid, or a solution of alum, is to harden the skin, so that it may not be inflated too much; and, if hairy, to prevent the hairs from falling out whilst being handled.

When preserving a brightly-coloured and hairy larva, such as *Bombyx Neustria*, I generally starve it until it is nearly dried up, and then kill it and take the inside out. In conclusion, I would remark that some amount of patience is requisite to insure success. Any further particulars or explanations that may be required I shall be most happy, if possible, to afford.—*Entomologist's Monthly Magazine.*

New Carving Machine.—In the machine invented by Mr. Gear, of Newhaven, U.S., the wood to be carved is fastened firmly to the bed by movable clamps, adjustable to suit any required size of wood, and the cutters are fastened to a spindle moved by a universal joint in any direction upon the bed of the machine. The cutter is guided by hand, the guide resting against the pattern. The carving can be gauged to any required depth, and made to conform to any required pattern. A fan blows away chips as fast as they are produced, leaving the work constantly in view of the operator. The same tool that cuts the mortise also cuts the tenon, the two pieces of work to be dovetailed being clamped together to the end of the table.

A NEW GARDEN PLANT.

Fig. 1.

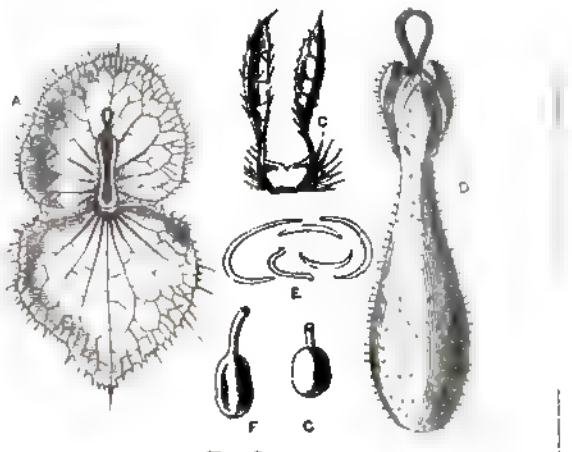


Fig. 2.

A NEW GARDEN PLANT (*BARLERIA LICHTENSTEINIANA*,[1] NEES VON ESENB.).

BY MAXWELL T. MASTERS, M.D., F.L.S.

THIS is one of the most peculiar-looking plants we have ever had the fortune to see, and though it is destitute of the attractive colours which render so many of its fellow Acanthads such favourites in our stoves, it is very far from inelegant. The structure of the flowers, and the arrangements apparently intended to prevent cross-fertilization and to secure self-fecundation, invest it with additional attractions for the plant lover. We will first give a general description, and then allude to some of the more striking peculiarities of the plant.

The shrub is covered over its whole surface with close, white, hoary down. The branches are slender, virgate, sub-angular. The leaves are opposite, 1-2 inches in length or longer, linear-lanceolate, entire, mucronate, with a central rib and numerous arched veins, tapering at the base into a very short stalk. The flower-spikes are axillary, 2-3 inches long, ovoid or oblong, consisting of a large number of closely packed overlapping bracts, all turned to the fore or lower part of the spike (second). Each bract is ovate-acuminate, mucronate, spine-toothed, 1-ribbed, with prominent and curved veins, and an inch to an inch and a half long. The calyx consists of four sepals in two rows; the two outer sepals are appressed, the posterior one, B, nearest the stem is suborbiculate, mucronate, spine-toothed, and ciliate, many ribbed, about an inch long; the anterior sepal, A, nearest to the bract is similar to the preceding, teeth smaller and unarmed; these two sepals project at the sides beyond the bracts, and completely hide the two inner sepals C, which decussate with the outer ones, than which they are much smaller (¼-inch long, one line broad), linear, spathulate, acute, ciliate, at the base. On the posterior side of the flower, between the two inner sepals, is a vacant space, apparently indicating the position of a fifth suppressed sepal. The corolla D is slightly larger than the inner sepals, of a brown colour, tubular, tube compressed from back to front, dilated at the base; its limb is divided into five short, ovate, erect, overlapping lobes, two external to the three others, and all so tightly appressed that they close the mouth of the corolla. Stamens 5, attached to the tube of the corolla a little below its mouth—2 fertile, 3 sterile; filaments erect, hairy; anthers of fertile filaments erect, adnate, sagittate, oblong, black, 2-celled—cells splitting lengthwise, and towards the centre of the flower. Pollen grains large, globose, reticulated. Ovary about two lines long, oblong-ovoid, compressed from back to front, 2-celled, with axile placentas: ovules 4, two in each cell, each orbicular, ascending, the lower one overlapping the upper one. Style cylindrical, ultimately longer than the corolla, curved at the apex, where it terminates in an obliquely truncated stigma. The fruit, which we have not seen, is described as tetragonal.

The inflorescence, with its curious one-sided arrangement of bracts, resembles in general appearance that of some composite, as Carlina, but is lateral, not terminal. The construction of the flower seems to favour self-fertilization, as will be seen from the following facts: the two outer sepals are closely pressed together, so that it is not altogether easy to separate them; the edge of the larger of the two sepals is spiny, and the teeth would seem rather to deter than favour the access of insects. The corolla is completely concealed within the sepals, its lobes are also

[1] "Fruticosa procumbens; spicis sessilibus secundis; bracteis dorsalibus ovatis incumbentibus, apice spinosis bracteolisque lanceolatis spinoso-dentatis; foliis ovato-oblongis spinoso-dentatis mucronatis petiolatis tomentosis; calycis lacinias exterioribus maximis late ovatis spinoso-acutatis dentatisque, 9-11 nervibus hirtis. Ad Grootrivier Prom. Bon. sp."—Nees von Esenbeck in *D. C. Prod.* xi. p. 235, 1847.

A SWISS LAKE VILLAGE IN THE BRONZE PERIOD.

tightly appressed and clip the stigmatic end of the style, and prevent its passage from the flower, so that the stigma is always included. If young flower-buds be examined, the style will be seen to be erect and straight (G), but as the style lengthens and comes into contact with the lobes of the corolla, its further progress is arrested, it becomes curved (F), and in the fully developed flower, D, the style forms a complete loop, owing to the stigma being retained within the corolla. Such are the appearances presented by the flower, and the inferences deduced from them. We have had no opportunity of testing how far those inferences are borne out in practice. For specimens of this singular plant we are indebted to Mr. W. Bull. Fig. 1 shows a branch with the under-side of the inflorescence; fig. 2 shows the details of the flower. A and B are the two outer sepals, natural size, forced open, showing the erect flower in the centre; C represents the two inner sepals, separated, natural size; D shows the corolla, enlarged; E is a section showing the arrangement of its lobes; G and F represent ovaries, with the young style beginning to become curved.—*Gardeners' Chronicle.*

Plumbago.—A Ceylon paper says, that if the world wants plumbago, and is willing to give a good price for it, Ceylon can supply the want. Fresh discoveries of the mineral are constantly made. Should mining continue at the rate of the past few years, Government will have to regulate the pursuit with reference to the safety of the people, otherwise lives will be lost from foul air and the collapse of badly-formed pits. We observe that the Chamber of Commerce found the specimens of this mineral sent some time ago from Hambantotte to be defective, from the presence of "rust," or, as the natives call it, "water-mark." The progress of this staple export has been from 46,000 cwt. to, in round numbers, 200,000. The quantity has considerably more than quadrupled in five years, and more than doubled in the last as compared with the previous season.

REVIEWS OF BOOKS.

L'Homme Primitif. Par Louis Figuier. Ouvrage illustré de 30 Scènes de la Vie de l'Homme primitif, etc. Paris: Hachette. 1870.[1]

PARAPHRASING the Shakspearian exclamation, we may well say of M. Figuier, "Forsooth, a great" compiler! There is no subject in science which is too comprehensive or too intricate to stay the intrepid hand of the French populariser of scientific knowledge. Botany, Geology, Entomology, Herpetology have all been dealt with by M. Figuier, after M. Figuier's own fashion, and now he has laid hands on the hitherto sacred realm of prehistoric archæology, and, as a consequence, we have before us a huge and handsome volume, in which we must admit that scissors and paste have not been spared. But, as we have often had to say before, when speaking of M. Figuier's labours, we are dissatisfied with the result taken *tout-entier*. The illustrations, so far as they are confined to scientific objects, are excellent, and they are not less numerous than good; indeed, this part of the work is so very perfect, that pictorially a concise account is rendered of the gradual evolution of man from the savage to the civilized condition. When we come to examine the text, we are compelled to be far less complimentary to the author. It is not that there is not abundance of matter, and matter, too, which is often taken from very excellent sources, but it is the author's mode of digesting the facts of which we complain. M. Figuier is not a

[1] The block from which the above illustration is printed was kindly lent by Messrs. Chapman & Hall, who are about to reproduce the work in English.

savant, he is merely a scribe. His early training, if it was scientific, must have been given in a very bad school. Hence we find that preconceived ideas, irrationalism, prejudice, and dogmatic expression abound throughout his writing, and deprive his teachings of any value they might otherwise possess, in developing the minds of his readers. As mere records of scientific facts, the compilations of this author are in some respects of very high merit; and, as we have already said, in illustration they surpass the popular works of English and German writers; but as works calculated to inculcate a sound scientific method of reasoning from facts up to generalizations and laws, we must say—and we should not be dealing conscientiously with our readers were we reticent on this point—that M. Figuier's works are the last we should think of putting into the hands of youth. It is a great and important responsibility, that which rests with the man who commends a work which may give a bias to the mind of youth, a turn which may lead it toward truth or from it, for ever; for

"Just as the twig is bent, the tree 's inclined;"

and feeling this, we cannot approve of M. Figuier's mode of dealing with opinions which, we will not say, he disbelieves, but which he dislikes. It is very easy to get rid of the theories of an adversary by saying that they are rubbish, and it is a method which M. Figuier affects to a very great extent; but it is one which is just as applicable to one side as to another, and it is one which utterly deprives a scientific work of any quality beyond that of being simply curious. To some persons this may seem unimportant; they will say, perhaps, that what we want are facts, and that the author gives us these. To this we should not object much did M. Figuier confine himself to facts; but as he proceeds to generalization, he should do so impartially,—and he does not. But is not the whole aim of scientific teaching to lead us to inferences which shall convey some truthful idea of the laws of the universe?—and we are sorry to think that in not a few instances M. Figuier's processes of argumentation are rather of the *ex cathedrâ* type.

There is, too, a little too much of self-glorification about the manner in which our author explains the nature of the task he has undertaken and the difficulties which encompassed it. It is not too much to say that it is simply an impertinence to Science to commence a preface in the following words, which we quote from M. Figuier's "fore-word":—

"J'entreprends ici d'exposer une Science qui n'existe pas encore. Les recherches concernant l'origine de l'homme sont déjà en nombre immense, mais elles n'ont pas été co-ordonnées avec suite et méthode. . . . . Personne jusqu'ici n'a entrepris de le débrouiller, et d'écrire un ouvrage *lié*, comme on le disait au dix-huitième siècle, sur tous les faits qui concernent l'homme aux premiers temps de son apparition sur la terre."

Now, though in the end of the preface the author admits the existence of Sir Charles Lyell's *Antiquity of Man* and Sir John Lubbock's *Prehistoric Man*; and though in part of the work he refers to Keller's and Nilsson's treatises, it is quite clear that he regards these as books of a rather inferior order, and as being terribly uninteresting. This is inexcusable. But what will our English readers say when they read the following criticism, which M. Figuier, with all the audacity of flippant ignorance, passes on the classic volume of the greatest geologist in the world:—

"The treatise of M. Charles Lyell, upon the 'antiquity of man,' a French translation of which appeared in 1864, is but a series of technical descriptions of the deposits of the quaternary period, in which traces of man are found. There is no order in all these notes, so bizarrely grouped together. . . . . Such is this treatise on the 'antiquity of man,' which gives a singular idea enough of the way in which the English geologist prepares his works."

As to the subject-matter of the work before us, it would be needless to enter upon an abstract of its contents. Suffice it to say that the author, following the scheme of division proposed by M. Lartet, describes *seriatim* the relics of primitive man which have been discovered in various parts of the world. Thus, much in the same order as that followed by Sir John Lubbock in his *Prehistoric Man*, and in his excellent translation of Nilsson's *Stone Age*, M. Figuier describes in detail the weapons, habits, habitations, and cotemporaries of the men of the rough-stone period, the polished-stone age, the bronze and iron epochs. In all these descriptions he is, of course, Gallically terse, clear, and concise; in fact, his chapters are by no means dry reading, and as they contain a number of facts almost new to many readers, they will be found of great interest.

We must, however, caution the reader against too readily accepting M. Figuier's assertions. Many of these are very questionable, and some are distinct mis-statements of fact. We cannot afford space for the correction of all the French author's errors; but we may point out a few, with the view of putting his readers on their guard. Let us take, for instance, the subject of the celebrated jaw-bone discovery at Moulin-Quignon, with which the name of M. Boucher de Perthes is so memorably associated. Here is a somewhat rough, but, we think, not inaccurate translation of M. Figuier's version of this historical matter.

"On the 20th of April, 1863, M. de Quatrefages announced to the Institute this discovery of Boucher de Perthes, and he presented to it the interesting specimens found at Abbeville. This intelligence produced a great sensation in England. The English savants who were especially occupied with this question, Messrs. Christy, Falconer, Carpenter, and Busq (*sic*)—came over to France, and, with M. Boucher de Perthes, examined the deposit containing the flint hatchets and the human jaw-bone, and [2] *they unanimously confirmed* the exactitude of the *conclusion drawn by the indefatigable archæologist of Abbeville.*"

This is one solitary specimen of M. Figuier's method of dealing with historical facts. Those who have read Mr. Busk's capital account of the jaw-bone in the *Natural History Review*, published shortly after the visit to Abbeville, are aware of the nature of the unanimity (!) alleged by M. Figuier, and they will remember how, by sawing the bone, Mr. Busk showed that the jaw was a recent one, which some clever workman had placed *in situ* and thus palmed off on the credulity of M. Boucher de Perthes, in a manner reminding one of Mr. Pickwick's well-known archæological investigations.

M. Figuier's treatment of the Darwinian theory and the controversy of the Neanderthal and Engis skulls is equally satisfactory with his account of the Abbeville mare's-nest. He is quaintly humorous *à propos* of the supposed anthropoid character of the Engis skull, for he says, regarding the statement that the skull is a well-developed and high one:—

"Hippocrates-Huxley says Yes, Galen-Vogt says No, and Celsus-Lyell says neither Yes nor No."

Of the page plates which accompany the volume, and which are in true French artistic style, from the pencil of M. E. Bayard, we are bound to confess that the book would have been much better without them. One or two are fair and passable, the remainder, though cleverly drawn, are simply monstrous representations, and are ridiculous to the very acme of absurdity. The man represented in all is from the same model, and is of a type of beauty and expression such as might be selected for either a Jupiter or a Christ; the ladies are unusually pretty and piquant, and were their costume a little less *décolletée* they would recall to mind the faces at Cremorne or the Burlington Arcade; in a word, as samples of prehistoric mankind they are preposterous—not ideal, but, as artists would say, "idealized." One of the best illustrations in the volume is that of a Swiss prehistoric lake dwelling, which we reproduce on p. 223, but this is taken from the noble treatise by Keller. In conclusion, we can only express a hope that Messrs. Chapman & Hall, who are about to issue an English translation of this work, will take some steps to correct its mistakes and "blot out all its iniquities."

[2] The italics are ours.—REVIEWER.

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The "London" Mounting Solution.—Mr. Sanford, of Red Lion-square, has, says the *British Journal of Photography*, forwarded to us a sample of a new print mountant, bearing the name at the head of this paragraph. It is semi-fluid in a very warm room, becomes thoroughly liquefied when placed in a vessel of moderately hot water, but at the normal temperature of the present month it is quite gelatinified. A special advantage of this preparation is, that prints may be mounted on any kind of paper with entire freedom from cockling. Since we got the sample of the "London Mounting Solution," we have used it on several occasions, and always with undiminished pleasure.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

WHO ARE THE DANAANS?—*From* DR. BEDDOE.

DEAR SIR,—While thanking you for your friendly review of my paper, "On the Stature and Bulk of Man," in the new volume of the *Anthropological Memoirs*, I should be glad to assure you of my orthodoxy as to the Danaans. I am far from confounding them with the Danes, of which heresy you seem to suspect me,—I know not why. [1]

Yours truly,

Clifton, Feb. 27. JOHN BEDDOE, M.D.

THE SOCIETY OF ARTS' LIBRARY.—*From* W. LLOYD WISE.

SIR,—Some months back I drew attention to the inconvenient arrangement of the Society of Arts' Library, and suggested a way of improving it. The letter signed "A New Member" in the *Society of Arts' Journal* shows that my complaints were well founded, and that my suggestion as to improvements was at least deserving of some consideration.

I have since written to the editor of the society's journal, but for some reason best known to those "in office," neither of my letters has been published. Under these circumstances I subjoin a copy of my last letter in the hope that you will favour me by its insertion in your valuable journal, and perhaps save some of your readers from being disappointed, as "A New Member," myself, and others have been.

Your obedient servant, W. LLOYD WISE, M.S.A.

Chandos Chambers, Adelphi, W.C., February 23.

"*To the Editor of the 'Society of Arts' Journal.'*

"Sir,—I have been much interested by the letter of 'A New Member' in your last issue, and I quite agree with the suggestion that the society's operations have now assumed a magnitude which demands the occupation of more commodious premises. But as 'Rome was not built in a day,' neither can the society expect to find new premises exactly suited to its present purposes at a moment's notice.

"I would not for an instant damp the energies of those who are disposed to exert themselves to secure a better building; but I contend that, in the mean time, we should make the bost of the one we have, which, as a matter of fact, and as I have frequently pointed out, is not being done.

"Your correspondent says, 'I have more than once or twice wanted to consult the library, but the library itself is used as a sort of exhibition room for models and pictures, and though it is no doubt desirable to have exhibitions, it is scarcely fair to do so at the expense of the utility of the society in other ways. The reading-room is partly an office, and partly a reference room, so that quiet study is out of the question. I joined the society, not from a purely philanthropic motive, but from a desire to avail myself of the advantages it offered, content, however, if a portion of my subscription went towards the general good. I feel somewhat that the society had no right to ask for my membership, if it could not accommodate me.'

"How well do these remarks tally with the following passages which I extract from my letter of 9th September last, to the *Times*, viz., 'But anybody who may join in the hope of finding the library as serviceable as might reasonably be expected from an influential society professing to do so much in promoting technical education, and so forth, will be, as I have been, sadly disappointed.'

"'Although there is a fine room available, it has been thought proper to lumber it up for years past with a lot of old and dirty models and scraps of metal in glass cases, which in their present state and position, can be of no use to anybody.'

"And now I come to the question of what should be done to make the most of the society's present house, pending the appearance of 'a new house.'

"To begin with, the society appears to be attempting too much for its present resources, and in so doing, is actually neglecting one of the first duties to its members,—that is, to provide every accommodation in the library.

"At present the exhibitions and the library are alike failures, because there is not the convenience required for both: hence it is clear that one of the two things should be abolished for the present; it is equally clear that this must not be the library. The general importance of the library demands that it should take precedence over the

[1] The answer to Dr. Beddoe is: From the context.—REVIEWER.

other matters which are now permitted to render it comparatively useless, and therefore I suggested months ago that 'the large room on the ground floor, which is at this time neither one thing nor another, should be converted into a commodious library and reading-room, which would be a credit to the society, and a real convenience to its members.' The present cumbersome glass cases might be either modified or superseded by other cases of a more suitable kind; and although the details of the alterations might require some little consideration, yet there can be no doubt as to the practicability of adapting the large room on the ground floor to suit the requirements of those members who may desire to use the library. It may be said that the present cases have been costly, and, furthermore, that the proposed alterations would involve some little expenditure; but although this may be so, common sense will dictate the expediency of expending a few pounds to save an old and influential society from that utter disgrace which a continuance of the present state of things must inevitably bring down upon it

"Your obedient servant,

"W. Lloyd Wise."

Transient Hemiopsia.

Sir,—Having read with interest, in Scientific Opinion, Feb. 23, your report of Mr. Hubert Airy's paper "On a Distinct Form of Transient Hemiopsia," and having myself been subject to very similar attacks between the ages of 12 and 17, and once at the age of 36, I feel it not improbable that my own experience may tend to elucidate the subject, and possibly suggest relief from suffering.

The blindness would come on quite suddenly; more than once while looking at a tablecloth woven with scarlet and blue; often while dressing for breakfast, when a portion of the left side of my face would disappear in the glass. The obliterating mass appeared to me like overlapping black bubbles, occasionally tinged with gold, but always rolling and growing outwards to the right, till every object had lost its left half.

This would continue from 15 to 20 minutes, when it passed off, and was succeeded by 8 hours of intense headache, with nausea, numbness in the hand, and the greatest difficulty in expressing myself. If I sang, I had to practise over what I had to say in order to be understood, as the syllables would come wrongly strung together.

Hoping to shorten suffering, I had been in the habit of immediately taking an emetic, but this appeared to make the attacks more frequent. Once, feeling very cold during the blindness, I drank a cup of strong ginger-tea, and for the first time no headache at all followed. Instead, therefore, of lying down in a darkened room, I went about my usual occupations, but discovered that the numbness and the difficulty of speech were still present, which surprised me, as I had always attributed the latter to the effect of severe pain. In succeeding attacks I always resorted to ginger-tea, with invariably the same result. I have known hot pickles succeed equally well in other cases. A. R.

Assuming the Name of Sowerby.—*From* C. Sowerby.

Sir,—An advertisement has appeared in Scientific Opinion in which it is stated that I "have assumed the name of Sowerby." Allow me to inform you that the business of my late father, G. B. Sowerby, has been in my possession since 1853; and in 1856, I became the owner of it by purchase. As the statement of which I complain is utterly devoid of truth, and likely to do me a great injury in my business, I shall feel obliged by the insertion of this letter.

I am, Sir, your obedient servant,

London, Feb. 27. C. Sowerby.

A New Insecticide.—M. Cloez, who is engaged at the garden of the Paris Museum, has invented what he considers a complete annihilator for plant-lice and other small insects. This discovery is given in the *Revue Horticole*, with the endorsement of its distinguished editor, E. M. Carrière. To reduce M. Cloez's preparation to our measures, it will be sufficiently accurate to say, take 3½ oz. of quassia chips, and 5 drachms of stavesacre seeds, powdered. These are to be put in 7 pints of water, and boiled until reduced to 5 pints. When the liquid is cooled, strain it, and use with a watering-pot or syringe, as may be most convenient. We are assured that this preparation has been most efficacious in France, and it will be worth while for our gardeners to experiment with it. Quassia has long been used as an insect-destroyer. The stavesacre seeds are the seeds of a species of larkspur, or Delphinium, and used to be kept in the old drug stores. Years ago they were much used for an insect that found its home in the human head, but as that has fortunately gone out of fashion, it may be that the seeds are less obtainable than formerly. The staves-acre seeds contain Delphine, which is one of the most active poisons known, and we have no doubt that a very small share of it would prove fatal to insects.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

Thursday, February 24th.—The following papers were read:—"Note on certain Lichens," by John Stenhouse, LL.D., F.R.S., &c.—Through the kindness of W. Carruthers, Esq., of the Botanical Department of the British Museum, I obtained a considerable quantity of lichens from the neighbourhood of Moffat in Scotland. These were *Cladonia rangiferina*, and a mixture of *Usnea barbata* and *Evernia prunastri*, the latter of which were carefully separated by picking—a somewhat tedious operation, as they were much interlaced.

Usnea barbata.—In order to extract the usnic acid from this lichen, it was macerated for about thirty minutes with a dilute solution of sodic carbonate, squeezed, again treated once or twice in a similar manner, and the turbid solution precipitated by a slight excess of hydrochloric acid. The crude dark-green acid thus obtained was mixed with milk of lime and a considerable quantity of warm water (40° C.), filtered, and the clear lemon-coloured solution of usnate of calcium acidulated with hydrochloric acid. The acid was thus precipitated in pale yellow flocks, which were collected.

The reason that I adopted this modification of the process I formerly proposed,[1] is, that although usnic acid readily dissolves in milk of lime when it has been extracted, yet in order to exhaust this and other compact lichens, it requires to be treated a great many times if lime be employed, whilst two or three are sufficient with carbonate of sodium.

The partially purified usnic acid obtained in the manner above described, was easily rendered quite pure by taking advantage of the peculiar property which this acid possesses, of forming an insoluble calcium salt when boiled with lime. The crude yellow acid was placed in a flask with a quantity of water and an excess of slaked lime, and the mixture boiled for twenty minutes or half an hour. The insoluble calcium usnate was collected, well washed with hot water, and the lime then removed by boiling it with a slight excess of hydrochloric acid. The tolerably pure usnic acid was then collected, and well washed with boiling water. It was advisable to continue the digestion with hydrochloric acid for half an hour, as it rendered the acid more compact and easy to collect. By this alternate treatment with lime and acid, a large quantity of some dark-coloured impurity was removed. This forms the best process for recovering usnic acid in a state of tolerable purity from residues.

It was found, however, to be better, when considerable quantities of usnic acid were to be prepared, to boil the pale yellow usnic acid paste, as obtained by precipitation from the lime solution, with a small quantity of water, to which strong caustic soda solution was gradually added, sufficient to dissolve nearly the whole of the usnic acid. It was then set aside to crystallize, and when cold the very dark-coloured supernatant mother-liquor decanted, and the crystals of sodic usnate washed once or twice by decantation, with a small quantity of cold water. It was then redissolved and recrystallized once or twice in the same manner.

The nearly pure sodic usnate was now dissolved in a considerable quantity of hot spirit, filtered, and the boiling solution strongly acidulated with acetic acid. The usnic acid then separated in fine needles, which when cold were collected, well washed with cold spirit (in which they are almost insoluble,) and recrystallized from boiling spirit to render them quite pure.

When the quantity of acid operated on was but small, the best means was to dissolve it by means of caustic soda solution in a large quantity of boiling spirit, filter from the insoluble impurities, and strongly acidulated with acetic acid. The nearly pure usnic acid which crystallizes out in large needles when the solution cools, was collected, washed, and recrystallized two or three times from spirit.

I. ·130 grm. usnic acid gave ·298 grm. carbonic anhydride and ·060 grm. water.

II. ·245 grm. usnic acid gave ·564 grm. carbonic anhydride and ·188 grm. water.

				I.	II.	Hesse.
C_{18}	= 216	=	62·43	62·53	62·79	62.80
H_{18}	= 18	=	5·20	5·13	4·99	5·00
O_7	= 112	=	32·37			
	358		100·00			

I. was purified by boiling with lime, and II. by repeated crystallization of the crude acid.

In the analysis published by W. Knop, Rochleder, and Heldt, and also by myself in 1848, the carbon is about ·75 per cent. higher than the above, and the formula deduced from it was $C_{19}H_{16}O_7$. Hesse[2]

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[1] *Ann. Chem. Pharm.*, vol. lxviii. p. 93.

[2] *Ibid.*, vol. cxvii. p. 345.

from his analyses proposed the formula $C_{18}H_{18}O_7$, which I have adopted.

Usnate of Sodium.—This was best prepared by adding one part pure usnic acid to twenty of boiling water, and then sufficient caustic soda solution to dissolve nearly the whole of the acid, filtering and setting aside to crystallize.

After one recrystallization it was subjected to analysis.

I. ·598 grm. usnate of sodium gave ·114 grm. sulphate of sodium.

II. ·864 grm. usnate of sodium gave ·168 grm. sulphate of sodium.

				I.	II.	Mean.
C_{18}	= 216	=	58·70			
H_{17}	= 17	=	4·61			
Na	= 23	=	6·25	6·18	6·30	6·24
O_7	= 112	=	30·44			
	368		100·00			

This salt crystallizes in pale yellow silky needles, is not very soluble in cold water, but more so in spirit. It is readily decomposed by carbonic anhydride; so much so, that when pure sodium usnate is exposed for some time to the atmosphere, it absorbs carbonic acid, and is no longer completely soluble in water. By passing a current of carbonic anhydride through its aqueous solution, the usnic acid is entirely precipitated.

Calcium Usnate.—When pure usnic acid was moistened with spirit, and then rubbed up in a mortar with milk of lime, it combined and formed a deep yellow paste, which on the addition of more water and filtration, yielded a lemon-coloured solution, containing calcium usnate and hydrate. When the solution was heated it became turbid, and after boiling some time, the whole of the usnic acid was deposited as an insoluble calcium compound, in the form of small deep yellow rhomboidal crystals. Although I made several analyses of this compound, prepared at different times, I was unable to obtain it of a constant composition, probably owing to its being mixed with variable quantities of calcium carbonate and hydrate.

The formation of this insoluble calcium salt is very characteristic of usnic acid, and is an excellent test of its presence. As with the sodium salt, carbonic anhydride entirely decomposes the calcium compounds. Usnic acid appears, therefore, to be a very feeble acid.

An attempt was made to prepare *ethylic usnate* by treating usnate of silver with ethylic iodide, but without success. When usnic acid was treated with bromine it was completely decomposed, and converted into an orange-coloured uncrystallizable resin.

Evernia prunastri—Evernic Acid.—The evernic and usnic acids that this lichen contains were extracted by the lime process, which consists in macerating the lichen two or three times successively with milk of lime for about half an hour each time. The solution of the mixed acids was then filtered, precipitated by a slight excess of hydrochloric acid, and the precipitate collected and dried. In order to extract the evernic acid from the mixture, it was agitated for about five minutes with four parts boiling alcohol and filtered. The acids remaining undissolved were treated two or three times with the same quantity of boiling alcohol, and the dissolved evernic acid precipitated by the addition of an equal bulk of water. By this means, the evernic acid, being readily soluble in boiling alcohol, was in a great measure separated from the usnic acid, which dissolves with difficulty in that menstruum unless digested with it for a considerable time. The crude evernic acid thus obtained amounted to about one-third of the mixed acids, and was purified by repeated crystallization from strong spirit, taking care not to digest it for any length of time. The process is much facilitated by completely removing the mother-liquors by Bunsen's vacuum filter.

Pure evernic acid, as has been already described by myself[3] and Hesse,[4] consists of aggregations of minute needles, melting at 164° C It is a feeble acid, and does not decompose solutions of bicarbonate of sodium in the cold; as, however, the adhering colouring matter is somewhat soluble in that menstruum, it may be employed to free the crude acid to a great extent from that impurity. The solution of calcium evernate is decomposed by a long-continued current of carbonic anhydride, which precipitates calcic carbonate and unaltered evernic acid.

On theoretical grounds it has been stated[5] that, by the action of potassic or baric hydrates, evernic acids should be resolved into orsellinic and everninic acids. This prediction, however, is incorrect, as I find, as formerly stated,[6] that everninic acid is the only fixed product.

Tetrabrom-evernic Acid.—Perfectly dry and finely-powdered evernic acid was treated in the cold with a slight excess of dry bromine, large quantities of hydrobromic acid were given off, and a brominated compound produced. In order to prevent any portion of the acid escaping bromination, the product was finely powdered and again treated with bromine. After standing some time to allow the excess of bromine to volatilize, the finely powdered compound was well washed with bisulphide of carbon, to remove the last traces of bromine, and a small quantity of a resinous body which is produced at the same time. Two or three crystallizations from boiling spirit render it quite pure. When subjected to analysis, it gave the following results:—

I. ·312 grm. acid gave ·362 grm. carbonic anhydride and ·067 grm water.

II. ·321 grm. acid gave ·373 grm. bromide of silver.

				I.	II.
C_{17}	= 204	=	31·48	31·64	
H_{12}	= 12	=	1·86	2·03	
Br_4	= 320	=	49·48		49·44
O_7	= 112	=	17·28		
	648		100·00		

This analysis agrees very well with the formula $C_{17}H_{12}Br_4O_7$, four equivalents of hydrogen in evernic acid being replaced by bromine.

Tetrabrom-evernic acid is rather soluble in hot alcohol, from which it crystallizes, on standing some time, in small colourless prisms. It is insoluble in water and bisulphide of carbon, slightly soluble in hot benzol, and readily in ether, which when quickly evaporated leaves it as a transparent colourless resin; it melts at 161° C. The acid is very soluble in alkaline solutions, which on evaporation dry up to a gummy mass. When heated with concentrated sulphuric acid it decomposes.

Usnic Acid from Evernia prunastri.—The usnic acid left undissolved in the preparation of evernic acid usually retained traces of that acid even after repeated treatment with alcohol, but this was entirely removed by boiling with lime, as described in the first part of this paper. This decomposed and removed the evernic acid and other impurities, leaving the usnic acid in the form of an insoluble calcium salt. The acid, when freed from lime and purified, melted at 202° C., and by analysis gave the following results:—

I. ·409 grm. usnic acid gave ·939 grm. carbonic anhydride and ·188 grm. water.

				I.
C_{18}	= 216	=	62·43	62·63
H_{18}	= 18	=	5·20	5·11
O_7	= 112	=	32·37	
	346		100·00	

From the above analyses it will be seen that the usnic acid from *Evernia prunastri* is identical in composition with that from *Usnea barbata*. It has the same melting-point, and agrees with it in all its other properties.

Cladonia rangiferina.—In 1848[7] I extracted the lichen acid from *Cladonia rangiferina*, and by analysis found it to have the same composition as usnic acid, with which it agrees very closely in its properties. Hesse, however, observed[8] that this acid had a different melting-point (175° C.) from ordinary usnic acid (203° C.), and proposed, therefore, as it so closely resembled ordinary usnic acid in its general character, to call it β-usnic acid.

Cladonic Acid, β-Orcin.—I formerly obtained[9] β-orcin by subjecting to destructive distillation a mixture of the acids from *Cladonia rangiferina* and various species of Usnea, but I have lately found that ordinary usnic acid, melting at 203° C., obtained from *Evernia prunastri*, *Ramalina calicaris*, and the various Usneas, does not yield a trace of β-orcin when distilled, whilst, on the contrary, the acid extracted from Cladonia (Hesse's β-usnic acid melting at 175° C.), on being subjected to the same treatment, yields β-orcin; thus showing a marked difference in the products of its decomposition from ordinary usnic acid, as well as in its melting-point. Under these circumstances, therefore, I think it would be better to name the acid from *Cladonia rangiferina* "cladonic acid," instead of β-usnic acid, as proposed by Hesse.

I expected to have been able to subject cladonic acid to a more careful examination, and procured for that purpose a quantity of *Cladonia rangiferina* from the neighbourhood of Moffat. Unfortunately, however, it was not gathered until the beginning of December, and I was surprised to find that it contained scarcely a trace of cladonic or any similar acid. I intend to obtain a new quantity next summer, when I hope to be more successful.

I cannot conclude this paper without acknowledging the efficient assistance I have received from Mr. Charles E. Groves.

"On the successive Action of Sodium and Iodide of Ethyl upon Acetic Ether," by E. Frankland, F.R.S., and B. F. Duppa, F.R.S.—In a paper by Mr. J. Alfred Wanklyn, bearing the above title, and published in the last number of the *Proceedings of the Royal Society*, vol. xviii. p. 91, the author refers to our memoir on the same subject printed in the *Philosophical Transactions* for 1866, vol. clvi.

[3] *Ann. Chem. Pharm.*, vol. lxviii. p. 84.
[4] *Ibid.*, vol. cxvii. p. 298.
[5] *Watts's Dict. Chem.*, vol. ii. p. 611.
[6] *Ann. Chem. Pharm.*, vol. lxviii. p. 86.
[7] *Ann. Chem. Pharm.*, vol. lxviii. p. 93.
[8] *Ibid.*, vol. cxvii. p. 347.
[9] *Ibid.*, vol. lxviii. p. 104.

p. 37, and expresses his opinion that our interpretation of the nature of the reaction must be erroneous because it involves the disengagement of hydrogen. This opinion is founded upon certain experiments which Mr. Wanklyn has himself made, and which are described in the number of Liebig's *Annalen* for January, 1869, and in the *Chemical Society's Journal*, vol. ii. p. 371.

In reference to this opinion we have to remark, first, that it is founded upon experiments which differ essentially from our own; and second, that even the results obtained in those experiments by the author do not warrant the conclusion, at variance with ours, which he has drawn from them, viz., that the evolution of hydrogen in this reaction is inadmissible.

The reaction, the theoretical explanation of which Mr. Wanklyn seeks to controvert, is described in the *Philosophical Transactions*, vol. clvi. p. 38, as follows:—"When acetic ether is placed in contact with sodium it becomes hot, and a considerable quantity of gas is evolved, which, after being passed first through alcohol and then through water, burns with a non-luminous flame, and the products of combustion do not produce the slightest turbidity on agitation with baryta-water. In fact the gas is pure hydrogen. When the action is complete, the liquid solidifies on cooling to a mass resembling yellow beeswax. By putting the sodium into the acetic ether as just described, it is difficult to conduct the operation to completion, owing to the liquid gradually assuming such a thick and pasty condition as to prevent the further action of the sodium." Owing to the difficulty of carrying the reaction far enough in this way we frequently employed a modification of this process, which is minutely described in the same memoir. The modification consisted in placing the sodium in a separate vessel and causing the acetic ether to distil continuously over it; thus the portions of acetic ether still unacted upon were brought, again and again, into contact with the sodium, whilst the non-volatile product of the operation was retained in a lower vessel. As we acted upon several pounds of acetic ether at once, the operation frequently lasted several days, and *during the whole time torrents of hydrogen were evolved*. The temperature of the liquid in the distillation vessel was allowed to rise to 130° C., and the amount of sodium consumed was not much less than one atom for each molecule of acetic ether employed.

We have made several attempts to determine quantitatively the volume of hydrogen given off from a known weight of sodium, and also from a known weight of acetic ether, but in neither operation could we obtain a trustworthy result. In the first case because the sodium, which fuses during the reaction, breaks up into a vast number of very minute globules, the final disappearance of which in the highly-coloured and pasty product it is impossible to verify. In the second case, because the thickening of the liquid prevents the reaction being pushed far enough to decompose the whole of the acetic ether employed. In a quantitative experiment, in which 4·857 grammes of acetic ether were acted upon by sodium in slight excess, 344·79 cub. centims. of hydrogen at 0° C., and 760 millims. pressure were obtained. If one molecule of acetic ether had lost one atom of hydrogen, 615·9 cub. centims. of gas ought to have been collected. It was evident, however, that a large proportion of acetic ether still remained unattacked at the close of the experiment.

Such, then, was our mode of operating; the hydrogen evolved was allowed freely to escape, the whole process was conducted at the ordinary atmospheric pressure, and the temperature varied from the boiling-point of acetic ether to 130° C. Moreover, the acetic ether used was prepared with the greatest care, so as to insure the absence of alcohol and water. By our method of preparation, described in the memoir already cited, no traces of the former could be detected even in the crude ether; nevertheless, it was first placed for several days over fragments of fused calcic chloride, which apparently remained perfectly dry and unaffected; it was then in some cases boiled for ten days or a fortnight upon many pounds of sodium-amalgam, which we find to be entirely without action upon pure acetic ether, whilst it rapidly attacks and removes alcohol, if the latter be added even in very small proportion to the acetic ether. When acetic ether, so treated, and then distilled from the sodium-amalgam, was brought into contact with the sodium, an abundant evolution of hydrogen, immediately commenced, and continued during the entire treatment, which, as already remarked, frequently lasted several days. The general impression, however, produced upon us by the whole of our operation was, that the evolution of hydrogen was not quite so great as that theoretically required by the reactions which we believe to take place; nevertheless, it was obvious that no equations, from which free hydrogen was excluded, could possibly correctly express the chemical changes effected in this action. Certain experiments were undertaken to trace the missing hydrogen, but as they have not hitherto been completed we will not further allude to them here.

We now turn to Mr. Wanklyn's mode of experimenting. This is not stated in his communication to the Royal Society, but is given in the *Journal of the Chemical Society*, vol. xvii. p. 371, and in the *Ann. Chem. u. Pharm.*, for January, 1869, as follows:—

Experiment 1.—"I sealed up a quantity of sodium with acetate of ethyl, *which had been very carefully deprived of alcohol and water*, and weighed the tube containing these materials. I then heated the tube to 130° C. for some time, until the contents had changed from liquid to solid. After opening the tube and allowing any gas that might have formed to escape, I weighed it again. *The loss amounted to* 0·5 *in* 100 *parts of acetic ether*."

Experiment 2.—"5 cub. centims. of good acetate of ethyl and 0·3 grm. of sodium were sealed up in a small glass tube and heated in a water-bath to 100° C. until all the sodium had disappeared. The tube was then opened under water; *the evolved gas measured* 25 cub. centims. at ordinary temperature, but at 0° C. and 760 millim. pressure and dry, it measured 23 cub. centims. If the volume of hydrogen be calculated, which is equivalent to 0·3 grm. sodium, it will be found to be 140 cub. centims."

Experiment 3.—"Another specimen of acetic ether, which was prepared with greater care, evolved no gas by the action of potassium or sodium."

It is thus evident that whilst we allowed all evolved gas freely to escape, Mr. Wanklyn operated in sealed tubes under great pressure—an alteration in the conditions of the experiment which might well lead to a modification of the result. Mons. L. Cailletet has recently shown that the evolution of hydrogen from zinc and hydrochloric acid is gradually diminished and finally stopped under increasing pressure; and the same chemist also finds that the evolution of hydrogen from sodium amalgam and water is diminished and finally stopped in a sealed tube. It follows from these experiments that pressure retards or even interrupts a reaction in which a permanent gas is evolved, whilst it is known to exercise little or no influence upon other chemical changes in which no evolution of gas takes place. This influence of pressure upon certain kinds of chemical action affords an explanation of the difference between the results of Mr. Wanklyn's experiments and our own, as regards the evolution of hydrogen during the action of sodium upon acetic ether. We can confirm his observation that sodium dissolves in valeric ether, under ordinary atmospheric pressure, without the evolution of any gas. A reaction, whatever its nature may be, which thus proceeds readily with ethylic valerate, can scarcely be impossible with its homologue, acetic ether, and it is probable that this reaction goes on side by side with those which we have described in our memoir; but when the pressure is moderate those changes chiefly take place which involve the disengagement of hydrogen, whilst under the great pressure arising in sealed tubes these changes are more or less suppressed, and the reaction observed by Mr. Wanklyn comes into prominence.

Lastly, Mr. Wanklyn's own experiments scarcely justify his unqualified opinion that "equations which assume evolution of hydrogen in these reactions are inadmissible." In two out of three of his experiments, hydrogen in considerable quantity was evolved; and although in experiment No. 2, given above, he attributes the hydrogen to the presence of alcohol, yet in experiment No. 1 its origin cannot be so explained, as he states expressly that the acetic ether employed "had been very carefully deprived of alcohol and water;" yet the proportion of hydrogen evolved in this case was much larger than in experiment No. 2.

We reserve our observations upon Mr. Wanklyn's views regarding the changes which take place when sodium acts upon acetic, butyric, and valeric ethers, until the publication of the experimental data upon which those views are founded.

CHEMICAL SOCIETY.

FEBRUARY 17TH.—Dr. A. W. Williamson, F.R.S., &c., president in the chair. The following gentlemen were elected fellows:—R. T. Atcherley, T. W. Axe, A. H. Bateman, E. Francis, A. Prangley, W. Pritchard, L. B. Ross, T. G. Rylands, T. Wills, P. Wright.

An account was given by Professor Tyndall of his researches on "The Action of Light on Gases and Vapours," illustrated by a series of beautiful experiments.

Dr. Tyndall began by remarking that it had, for the last ten years, been his endeavour to make radiant heat a means of getting an insight into the working of the atomic forces, or, in other words, into the state which is called chemical combination. Whilst pursuing his experiments with luminous waves on matter in a finely divided state, he was forced to imagine molecules and atoms; indeed, his belief in the existence of atoms is founded more upon those physical evidences than upon the considerations which are current in the chemical world. If he had to give up the notion of atoms, and to replace that conception by the abstract idea of multiple proportions, he would feel completely at a loss how to account for changes in the physical properties of matter. After these introductory remarks, the lecturer proceeded to the main subject. The apparatus which served to illustrate the statements consisted of a glass tube, about 8 ft. in length and about 3 in. internal diameter, closed at each end by glass disks. This tube, after having been exhausted by an air-pump, was partially filled with dry air which had been permitted to bubble

through the liquid whose vapours were to be examined. The condensed beam of an electric lamp was now caused to pass through the tube from end to end.

Since the aim of these experiments is to render visible the chemical action of light upon vapours, substances have been chosen, one, at least, of whose products of decomposition by light has so high a boiling-point that, as soon as it is formed, it is precipitated. Nitrous oxide gas, the vapours of amylic iodide, amylic nitrite, benzol, &c., mixed with some air which had passed through hydric nitrate or hydric chloride, were found well suited for this purpose. In all cases, no matter what the nature of the vapour was, if only employed in a sufficiently attenuated state, the visible action commenced with the formation of a blue cloud, which, in some instances, was of the deepest azure tinge, rivalling the colour of the purest Italian sky. When a cell containing some of the liquid whose vapours were to be examined was inserted between the lamp and the tube, no clouds were formed within the tube—the luminous waves traversing the liquid had been deprived of their acting power. When polarized light was sent through the tube, the blue cloud was visible only in one direction, the direction varying according to the position of the Nicol prism. When the short diagonal of the Nicol was vertical, the blue cloud was seen when the spectator's eye looked horizontally upon the tube, not otherwise. As soon as the prism was turned round its axis, the blue cloud was only seen when the line of vision fell vertically upon the experimental tube.

After concluding his account of this highly-interesting subject, Professor Tyndall showed some of the experiments bearing on his researches upon Dust, quite recently communicated at the Royal Institution.[1]

LINNEAN SOCIETY.

FEBRUARY 17TH.—G. Bentham, Esq., president, in the chair. Mr. R. B. Sharpe was elected a fellow. The following papers were read:—"Notes on the Tree-ferns of British Sikkim, with Descriptions of Three New Species, and Supplemental Remarks on their Relations to Palms and Cycads," by Mr. J. Scott (illustrated by an extensive series of drawings), "On the Commelynaceæ of Bengal," by Mr. C. B. Clarke; both communicated by Thomas Anderson, M.D. Extract of a letter from Dr. H. F. Hance to Dr. Hooker, dated Whampoa, October 14, 1869, and giving a highly interesting account of the botany of the White Cloud (Pakwan) Hills, near Canton.

ETHNOLOGICAL SOCIETY.

FEBRUARY 22ND.—Professor Huxley, F.R.S., president, in the chair. Mr. E. Backhouse was announced as a new member.—By the courtesy of Dr. Lockhart, a calva from China was exhibited by Professor Busk, F.R.S., in illustration of a former paper on an ancient calvaria which had been assigned to Confucius. The skull is mounted in copper, and was formerly supported on a tripod and furnished with a lid. The president, Mr. J. W. Flower, Dr. Hyde Clark, and Dr. A. Campbell, spoke upon this communication.

A paper was read on discoveries of archæological interest in recent deposits in Yorkshire, by C. Monkman, Esq.—The author described the discovery of worked flints in the clay of Kelsea Hill, in the East Riding of Yorkshire. This was formerly regarded as belonging to the Hessle clay—a post-glacial deposit unconformable to the true boulder-clay of Holderness; but it is probably only a derivative clay washed from the Hessle deposits on Kelsea Hill, and may therefore be of comparatively recent origin. Large finds of implements of neolithic type are said to have been made in the York sands. Many stone implements have also been found in the old river-deposits in the Vale of Pickering, chiefly turned up in the prosecution of land-drainage works. The paper was illustrated by a splendid collection of specimens. A discussion followed, in which Mr. Flowers, Rev. J. L. Rouse, Dr. Nicholas, and Mr. Judd took part.

A long paper was then read on the natives of Naga, in Luzon, Philippine Islands, by Dr. Jagor, translated from the German by Mr. Rudler. The author described in detail the manners and customs of the Bicol Indians inhabiting this locality.

Dr. A. Campbell inquired whether there was any connection between the name of this place and the Sanskrit *naga*, a snake.

ENTOMOLOGICAL SOCIETY.

FEBRUARY 21ST.—Mr. Alfred R. Wallace, president, in the chair. The following elections took place:—Professor Schiödte, of Copenhagen, and Professor C. T. E. von Siebold, of Munich, as honorary members; Messrs. Bernard, J. Lucas, and J. T. Porritt, as annual subscribers.

[1] From the *Chemical News*.

Mr. J. Hunter exhibited a Plusia from the New Forest, supposed to be *P. ni*. Mr. Albert Müller exhibited galls formed in the florets of *Tanacetum vulgare* by dipterous larvæ. Mr. Pascoe exhibited the *Hiketes thoracicus* of King, which was identical with the *Nepharis alata* of Castelnau, so that Mr. King's name would sink as a synonym.

Mr. A. G. Butler read a paper "On Butterflies recently received by Mr. Swanzy from West Africa."

VICTORIA INSTITUTE.

AN ordinary meeting of the Victoria Institute was held on Monday evening week, at 8, Adelphi-terrace, Rev. Dr. Thornton, vice-president, in the chair.—A paper was read on "Spontaneous Generation, or the Problem of Life," by the Rev. Professor John Kirk, of Edinburgh. The paper had especial reference to the Atmospheric-germ theory, and to the doctrine of Evolution. The following is an extract:—Life in an object is *self-movement*. It is this which constrains us to reason about life as we never dream of reasoning about any other form of motion. It is this which compels us logically to look beyond the region of observation to which the material eye and lens are confined, and to see, so to speak, that which neither telescope nor microscope can reveal. *Thoughts* cannot be seen by means of the microscope, yet thoughts are surely as real as the movements of vibrios; that which thinks cannot be purified by being passed through potassium, yet it is as real as the air which may be so affected; the substances which think cannot be "resolved" by the telescope, yet they are at least as truly existent as the nebulæ. When fairly in the midst of true thoughts, such as surround the idea of life, we speak of it as a *force* and not as a movement. It is now no longer motion, but that power which moves. The problem of life, then, is not the problem of a movement, but of a faculty. It takes us back beyond the motion which can be seen to the *motive entity* which cannot be seen.

To pure materialism, the dormant seed or germ is not alive. It is not in motion, and that which is not in motion in strict materialism is not living. A materialist regards a fresh though dormant seed as alive; but when he does so, he departs from his materialism. He goes beyond "phenomena," for there is no such phenomenon as lets life be seen so long as there is no visible movement in the germ. Place that germ under the microscope while as yet it is not affected by the conditions of growth, and there is nothing to be seen which tells of actual life. The strictest materialist knows that there is life there—that there is something essentially the opposite of that which is where the germ has been deprived of its vitality. That something is life: but he does not know it—he cannot possibly know it—except by reasoning, which informs of that which cannot be seen or in any way subjected to the senses. It is not at all needful to regret such an inconsistency or to confine ourselves to *seen life*.

To generate is to give beginning. Used in such a discussion as the present, generation means the giving of a beginning to life or self-movement in an individual plant or animal. Spontaneous generation literally would mean to give such a beginning to oneself, and would of course be absurd. But the phrase is not used literally. The idea which it is intended to represent is that of the lifeless giving origin to the living. The inorganic is thought of as giving origin to the organic, and the vegetable as giving origin to the animal. It is true that as yet the only notion which evolutionists attempt to support is that of previously organic molecules giving origin to individual life, and the vegetable thus generating the animal; but that is of no value to their system of thought apart from the truly inorganic generating the organic, at least in the vegetable. The chain of evolution is incomplete and useless to their purpose until this link is forged and inserted.

Darwin speaks of the creation of a few forms, or of one; but if the notion of those who hold to really molecular generation held good, he would have no need for such a thought. Here, for example, is an infusion of hay, and it has been so treated that all truly organic existence in it is held to be destroyed. If it could only now be fairly regarded as inorganic matter,—if living plants, however small, could be seen springing into existence from it, and if these mere plants could be seen uniting themselves and becoming self-moving animals, what a grand commencement would here be made for the Darwinian theory! It wants only sufficient time, and the films that become molecules, these molecules that become vibrios, these vibrios that become higher forms, and these higher forms that become higher still, shall reach the human form at last. The symmetry of the notion is perfect. The mischief-maker in the case is that enemy of all mere notions—stern old Fact. It is no doubt wonderful how this old foe is evaded, and even wheedled into something like acquiescence for a time; but ever and again, like Galileo on the earth's motion, he spoils the sport by assertions that damage the whole structure of fond fancy.

Let us try, by means of some suitable illustration, to have a good, clear view of this notion as to the origin of life. Perhaps we cannot get a better than that which is found in the case of a grave professor

who is an enthusiast in this same notion. It is far better to take one who is on the positive side in favour of a fancy, and to take his facts and arguments, than to take one who is on the negative side and opposed. Well, this gentleman has his students around him and a first-rate microscope on the table. He has before him an infusion of hay as well as infusions of certain other substances, vegetable and animal. Let us attend to that of hay. The dried grass has been steeped for a considerable time in water; the infusion has been boiled pretty thoroughly. It has been carefully excluded from all contact with ordinary atmospheric air, that substance having been admitted to it through such media as must effectually exclude or destroy all germs of plants or animals which it might contain. The infusion has been kept bottled up for some months, to give time to the process of generation. A thin scum now floats on the surface of this infusion. With the point of a needle, the professor or an assistant lifts the smallest portion of this film and places it under the object-glass of the microscope. This fragment is now seen by some, though not by all who look through the instrument, to consist of a mass of minute molecules, some of them so small as to be called "the minutest visible points," and others, of the larger sort, "one thirty-thousandth part of an inch in diameter"! If the observation is continued long enough, or repeated at proper times, these molecules are seen to unite in twos and threes and fours, and up to eights. By-and-by self-moving creatures are said to be the result of these unions of molecules, and it is concluded that life without parentage has taken place. These first creatures die, and a new film is formed on the infusion, from which another set of animalcules are developed; these die, and another set come, and so on. This is clearly the evolution of higher forms from the ashes of lower going on in the microscopic world!

In the discussion which ensued, the following gentlemen took part: Mr. C. Brooke, Mr. Reddie, and the chairman.

EDINBURGH BOTANICAL SOCIETY.

THE society met on Thursday, 10th February, at 5, St. Andrew-square, Sir Walter Elliot, K.S.I., president, in the chair.—Donations to the Library, Herbarium, and Museum, were laid on the table. The following communications were read:—

"Remarks on the Flora of Shetland," by Mr. Alex. Craig-Christie.

"Account of Botanical Excursions made in the Island of Arran during the months of August and September, 1869," by Professor Balfour.

"Sketches of the Botany of Lord Howe's Island," by Charles Moore, Esq., Director of the Botanic Garden, Sydney; communicated by Dr. Cleghorn.

"Botanical Notes from Naples," by Professor Allman.—In a letter to Professor Balfour, dated Naples, 28th January, 1870, Professor Allman says:—It is now about five weeks since we reached Naples. I have not been so successful as I had hoped in the exploration of the Neapolitan fauna. Some good work, however, I have done. I have gone over the ground of some of the old naturalists, and have found several new species, besides turning up some of the old ones which had not been noticed since the time of Cavolini. I am putting up some interesting things for the Museum.

You have no idea of the wretchedness of the weather here. Were it not that every one is agreed in calling this a most exceptional year, the fine climate of Italy must be regarded as a delusion. At this moment Vesuvius and the surrounding hills are covered with black-streaked dirty-looking snow, which in the course of twenty-four hours will probably have all disappeared, to be renewed in a day or two again, while a bitter penetrating north-east wind—the tramontana, as they call it—is cutting its way through and through one, and making us long for our honest bracing Edinburgh winter, which lays no claim to climatal amenities. And yet there is, after all, something very wonderful in these Neapolitan winters, something which gives them a special charm, and while we shiver in the cold, amuses us with the aspect of summer which surrounds. The ilexes and stone pines, and other evergreens, are in such profusion that we scarcely miss the foliage of the deciduous trees. In the villas the oranges are growing in the open ground, where they attain the size of some of our largest evergreens, and are now laden with their ripe fruit. Camellias nearly as large grow equally without protection, and are flowering as freely as in our conservatories. *Schinus molle* is in every garden, with its drooping branches and beautiful racemes of red fruit; and there are gigantic magnolias, and bays, and oleanders, and eucalyptuses. Australian mimosas are now in full flower, and casuarinas are carrying their cones, and in the male tree every pendant branch is continued into a long moniliform group of flowers. *Araucaria brasiliensis* is also in abundant fruit, and *A. excelsa* is here a magnificent tree, attaining a height of 70 ft., and with its whorls of branches perfect from root to summit. Then there are date palms, with a height of from 40 to 60 ft., with their heavy clusters of golden fruit, which, however, rarely ripens, and *Chamærops humilis*, with stems of from 4 to 15 ft. in height. On every rock and cliff in the suburbs, and round every village, and everywhere along the dusty roads, are Agaves and Opuntias as common as furze-bushes and brambles are with us.

But it is the indigenous flora after all which, in my opinion, gives a special and peculiar charm to the Mediterranean vegetation, and possesses an interest beyond that of all the introduced plants, however beautiful. It is on the coast road from Naples to Amalfi that we have the native flora in perfection, for though still rather early in the year for its full development, the hill-sides are clothed with Arbutus, and arborescent heath and myrtle, and Cistuses and rosemary, wherever the native vegetation is not displaced by terraces of lemons, and oranges, and olives. The Smilax clings wherever it can get support; the woods are filled with purple crocuses, and the broad leaves of the Cyclamen give promise of a carpet of flowers somewhat later; the little Italian Arum is in blossom in every shady nook, and wherever there is a moist rock the beautiful fronds of the *Adiantum capillus-veneris* form a tapestry of exquisite verdure. Those who have seen only the flora of Northern and Central Europe can have no conception of the wonderful richness and beauty of the vegetation of the warmer temperate zone.

Professor Allman adds:—I paid a visit the other day to Mrs. Somerville, on her ninetieth birthday. She is a charming old lady; her senses, with the exception of slight failure in her hearing, are still perfect; she can thread her needle without spectacles, and is in full intellectual vigour. She is engaged with a second edition of her work on *Molecular Science*.

"Report on the Open-air Vegetation in the Royal Botanic Garden," by Mr. M'Nab.—The author remarked:—It has been my practice for the last twenty years to lay before the Botanical Society, at the February meeting, a notice of the spring plants then in flower. Frequently the list has been large. Last February meeting twenty-four species were noticed as being in bloom. This year, however, I can only record the flowering of the *Tussilago fragrans* on the 18th January, and the snowdrop (*Galanthus nivalis*) partially on the 2nd February. During the winter, the hellebores have been flowering profusely, while the *Primula vulgaris* var., *Gentiana acaulis*, and wallflowers have produced blooms more or less throughout the winter, and cannot therefore be recorded amongst the true spring-flowering plants. Up to this time we have experienced a good deal of frost. On nineteen mornings since the 1st January, the thermometer has been below the freezing point, the six lowest being on the 11th, 22nd, 24th, 27th, and 30th January; also on the 10th February, falling respectively to 25°, 25°, 26°, 17°, 20°, and 21°; while the six highest morning temperatures during the same period were on the 7th and 8th January, also on the 1st, 3rd, 5th, and 7th February, indicating respectively 38°, 38°, 36°, 36°, 37°, and 39°. It was not till the 4th February that the frost entirely disappeared out of the ground; since then the rush of spring vegetation has been considerable, and if it receives no material check, a number of the spring flowering bulbs will be in flower immediately.

Presentations and Exhibitions.—1. Dr. Daniel Wright exhibited and presented specimens of a caterpillar with a fungus grown out of the anterior part of its body. The species is frequently met with in this condition in the north of Nepaul. He also presented a specimen of a kind of peat lately discovered in Nepaul, and now being largely used for fuel there. 2. Rev. Dr. Andrew Thomson presented specimens of plants which he had collected in Palestine during his recent visit there. 3. Professor Balfour exhibited an alpenstock, upwards of 6 ft. long, made of orange wood from Mentone; also a collection of dried specimens of the foliage of the trees growing along Sir Walter Scott's favourite walk at Ashestiel, a name which may be derived from the trees of ash and tiel (Tilia, lime-tree or Linden) which grow there; Professor Balfour also exhibited, under the microscope, sections of fossil-plants from near Laggan, in Arran. 4. Mr. Oswald Brodie presented a large collection of grasses from Ceylon. 5. Mr. J. B. Webster, forester, presented a twig of *Wellingtonia gigantea*, bearing ten cones, from the plantations of Sir William Verner, Bart., Churchill, Verner's-bridge, Moy, Ireland.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

THE ordinary meeting took place in the theatre of the College of Medicine, on Thursday, February 24. Mr. C. R. A. Wright read the following notes "On the Reaction of Chlorine on Sulphur Salts."—The following experiments, made some years ago in the laboratory of Owen's College, under the superintendence of Dr. Roscoe, may be of some interest as bearing on the action of chlorine and its congeners on the sulphur acids.

In order to see how far the action of equivalent quantities of chlorine, bromine, and iodine on the same sulphurous acid solution are comparable, solutions were prepared, one containing five grammes of iodine per litre, and the other such a quantity of sulphurous acid that a litre represented about 150 Ccs. of the iodine solution; the exact relation between the two was determined before and after each set of experiments, and it was found that no appreciable alteration took place during the duration of any one set of experiments. A solution of washed chlorine in distilled water was also prepared and

kept in the dark, and when required diluted with distilled water to the required strength; the stronger solutions were weighed out in sealed glass bulbs, subsequently broken under the surface of the liquids to be acted on.

A. Known quantities of chlorine solution were added to a measured column of sulphurous acid solution, the latter being in slight excess; this excess was then titrated by the standard iodine solution.

B. Cl solution was added to potassium iodide solution, and the liberated iodine treated as the chlorine in *A*.

C. Carried out as *B*, but potassium bromide used instead of iodide.

D. Bromide liberated as in *C* by Cl and KBr; KI then added, and the iodine thus liberated by bromine treated as that obtained in *B*.

It is clear from the above-described experiments that the difference in the action of chlorine and iodine does not depend solely on the strength of the solutions used; probably temperature and photochemical action are also concerned.

Assuming that the action of iodine on sulphurous acid, under the circumstances experimented on, is always represented by the equation $H_2SO_3 + H_2O + I_2 = 2HI + H_2SO_4$, it is evident that chlorine or bromine *might* cause the destruction of *more* SO_2 than corresponds to this equation, if their actions caused the formation of thionic acids; thus for tetrathionate, which, as the preceding experiments show, is only slowly acted on by iodine.

Tetrathionic Acid.

$$7H_2SO_3 = H_2S_4O_6 + 3H_2O + 3H_2SO_4.$$

But how it happens that a *less* quantity of SO_2 is sometimes destroyed by chlorine than by the equivalent amount of iodine is more difficult to explain; possibly, though this does not seem a very probable supposition, under the influence of light, or of other unknown circumstances, free oxygen may be formed, which escapes without exerting its due influence on the sulphurous acid.

$$2H_2O + 2Cl_2 = 4HCl + O_2.$$

It thus appears that the action of iodine is nearly the same, whether directly set free by Cl, or liberated by the circuitous process of evolving bromine from Cl and K Br, and then causing this bromine to act on KI, since the numbers obtained are no more different than might be anticipated from the combined effects of experimental errors, volatility of bromine, &c.; whilst the action of bromine in the two weaker solutions appears to be nearly the same as that of iodine, whereas in the stronger solution a larger quantity of SO_2 is destroyed by bromine than by iodine; lastly, the action of chlorine appears in the weakest solution to be nearly identical with that of iodine, but in the stronger solutions differs considerably therefrom, and this difference, unlike that in the case of bromine, indicates a destruction of *less* SO_2 by chlorine than by an equivalent quantity of iodine.

It is shown also that free oxygen in aqueous solution acts comparatively slowly, at any rate in the dark, on sulphurous acid solution.

It appears that while variation of temperature makes but little alteration in the action of iodine, it has a great influence on that of chlorine, the difference being greater the higher the temperature, and always indicates the destruction of more SO_2 by chlorine than by iodine; that at 0° there is little difference between the action of a saturated solution of Cl and one containing only about one-ninth of that amount.

These experiments would tend to show that when the action of chlorine on sulphurous acid takes place, not under the influence of light, a larger quantity of acid is destroyed than corresponds to the equation $H_2SO_3 + Cl_2 + H_2O = 2HCl + H_2SO_4$, this extra amount varying with the temperature, and possibly with the strength of the solution; whilst if the action takes place in daylight the result is so modified that sometimes more and sometimes less acid is destroyed than that indicated by this equation. In the case of bromine also, apparently, there is some irregularity in the action under different circumstances, as is shown by the non-uniform results obtained on repetition of determinations. Iodine, on the other hand, as Bunsen has shown (*Ann. Chem. und Pharm.*, lxxxvi. 265), acts with great regularity and uniformity in accordance with this equation under considerably varied circumstances, unless a solution containing more than 0·4 grammes of SO_2 per litre be used.

LIVERPOOL CHEMISTS' ASSOCIATION.

The ninth meeting of the twenty-first session was held at the Royal Institution, Colquitt-street, on Thursday, the 24th inst., the president, John Abraham, Esq., in the chair. After the transaction of some formal business, the honorary secretary, Mr. E. Davies, called the attention of the meeting to a case lately tried in the Liverpool Police-court where a woman had been tried for administering *savine* in order to procure abortion. The prosecution had failed, but Mr. Davies pointed out the facility with which such herbs may be obtained at herbalists' shops, and the necessity for taking steps to prevent their sale. Some discussion ensued, and it seemed to be the general opinion that the Pharmacy Act could be made available for preventing the sale of this herb and others of similar character by herbalists and other persons, unless they had passed the examinations of the Pharmaceutical Society.

Mr. Charles Sharpe afterwards read a most interesting paper, entitled "Two Centuries of Patented Inventions in Physics and Pharmacy," which evoked considerable discussion and much applause. In the course of his remarks he observed:—The conviction forced upon the mind when glancing over the specifications of patents relating to physic and pharmacy extending from 1632 to 1862 is that the Patent Office has been used largely by quacks and adventurers. During the latter half of the seventeenth century, and nearly through the eighteenth, the inventors of the grossest absurdities under the title of patent medicines were the chief patentees; so that nearly three-fourths of the specifications will be found to relate to the cure of multitudinous diseases by the use of infallible and abominable preparations. It is only at intervals that an invention of any importance appears, and even then it is too often set forth in such a manner as to render any full comprehension of the process impossible. Another striking fact, and one much to the honour of scientific men, is that the most memorable processes have never passed the portals of the Patent Office, but have been described in scientific journals so liberally that all the world might take advantage. The first patent was taken out by Thomas Grent in 1632, and was for a "movable hydraulike," the object of which was to cause sleep by a combination of musical sounds and a moist atmosphere. If we omit some chemical processes patented by the celebrated Nehemiah Grew and others, for years there is nothing but a long dreary list of mere quackeries, devised by men who were restless until they had furnished his Majesty's subjects with remedies for all ills. Timothy Byfield's "Sal oleosum volatile" is succeeded by Lovel's styptick, stated to be very useful for "those particular diseases from which the blacks suffer greatly in their passage from Guinea to the West Indies," and who, heaven knew, were in the extremest want of physic. These, and the "Specifick Pill," which had for its object the sweating of one limb of the body at a time, are but specimens of a considerable portion of the volume of specifications relating to medicine. It is somewhat refreshing as we approach modern times to come upon medicated baths, trusses, artificial teeth and limbs, and "false or downy calves in stockings, a thing never before put in practice, and which would be of great public use and utility."

Among mechanical inventions, the most noticeable are those of Brockedon and Hancocks, for various applications of India-rubber, Coffey's Esculapian apparatus, and others, too numerous to mention, referring principally to surgical appliances. The list of patents for the cure of sea sickness, is curious. One consists of an embrocation, another of "a new liquid," not unlike toddy, another of an arrangement of small balloons, each fastened to a ship's deck, and seating a passenger who substitutes the swinging movement of the machine for the contrary motion of the vessel. In addition to these is a large platform, fixed to a piston-rod worked by steam, upon which the passengers ride while in the agony of the ailment which affects landsmen when upon the sea.

Among patented processes for producing anæsthesia are those of Morton and Jackson, by the use of ether, and Blundell's, in which a freezing-mixture is kept flowing over the part of the body operated upon.

A considerable number of specifications appear relating to the preparation of medicines, and to the improvement of pharmaceutical processes.

We are very largely indebted to the scientific journals for the publicity given to new inventions, and for the liberal spirit which prompts a man to scatter broadcast the fruits of his own intellect. There are, of course, certain processes of such a nature as to render it a reasonable thing for a man who has brought to their production brain and time to receive a fair remuneration for his outlay. Still, there are others of so slight or ridiculous a character, as to deserve no protection at all; and it is certainly to the credit of the present race of pharmaceutists, that they do not look up every professional wrinkle in letters patent.

LIVERPOOL GEOLOGICAL SOCIETY.

A meeting of this society was held on Tuesday evening, February 15th, when G. H. Norton, Esq., F.G.S., &c., occupied the chair.—Some matters of interest to the society were brought forward by different members, and afterwards a paper was read by the president, entitled "On Cotta's Classification of Rocks."—The author described the arrangement of the rocks proposed by Jukes, Dana, and Cotta, and said *The Classification of Rocks*, by Dana, is the only English work exclusively devoted to the subject, and is particularly valuable on account of the very exact description it contains of the igneous rocks. The growing importance of microscopical research in investigating the composition of rocks was also referred to. The paper was

altogether very valuable in information and suggestions, and elicited considerable discussion.

The honorary secretary, Mr. Hugh F. Hall, F.G.S., also contributed an interesting paper, which afforded matter for discussion and reflection.

After a vote of thanks to the authors of the papers, the meeting was brought to a close.

GLASGOW NATURAL HISTORY SOCIETY.

The sixth meeting of the session was held on Tuesday evening, February 22nd, in the Library of Anderson's University, Mr. David Robertson, F.G.S., vice-president, occupying the chair. Mr. Henry E. Clark, Royal Infirmary, was elected a resident member.

Mr. Thomas Chapman exhibited specimens of *Venilia Macularia* which he had captured in June last in the Pass of Leny, Perthshire; and the Rev. James E. Somerville stated that he had taken the species in some numbers in Argyllshire, both at Loch Awe and Oban.

The secretary exhibited a small collection of starfishes, which had been forwarded from Girvan by Mr. T. Anderson, corresponding member. In this series, which showed the relative numbers found in deep water off the coast of that part of Ayrshire, there were specimens of *Goniaster Templetoni* and *Asterias Aurantiaca* in equal numbers. *Solaster Endeca*, which is a common species on some parts of the east coast, is rather scarce in the west, and *Palmipes membranaceus*, three specimens of which had previously been forwarded for exhibition by Mr. Anderson, was probably the rarest of the Girvan starfishes.

Mr. Duncan M'Lellan exhibited monstrosities of the common ash and hawthorn from the Queen's Park; the former showing the twigs flattened like the horns of a reindeer; the latter having its branches tortuous like a corkscrew. Both specimens presented a very unusual appearance.

Mr. Alexander Donaldson exhibited an example of malformation in the bill of a rook, regarding which Mr. Gray observed that it possessed additional interest from the fact of its showing only a partial abrasion at the base of the bill, and that it had been arrested probably in consequence of the malformation. Drawings of other malformations were exhibited by Mr. Gray, from which it was seen that when the mandibles were crossed to any extent, the deformity effectually prevented this bird digging into the ground, as it is habitually known to do, and that as a result the nostrils, forehead, and chin were fully clothed with feathers, like those of a carrion crow. In examples, however, where the upper mandible projected over the lower even twice its own length, the abrasion was found to be perfect like that seen on an ordinary specimen. This was explained on the ground that the prolongation of the mandible had taken place after the feathers had been denuded, and that this bareness becomes permanent on account of the bulbs from which the feathers arise having been destroyed, and thus rendered unproductive.

Mr. John Gilmour exhibited an unusually dark specimen of the hooded crow (*Corvus cornix*), which had the light space on the breast and shoulders very much clouded, giving the bird the appearance of a variety of the carrion crow (*C. corone*). Mr. Gray took the opportunity of saying that he had long held the opinion that these two birds are identical. No real difference existed except in the markings, and as these were known to vary they could hardly be entitled to specific value. The two birds were also known to breed freely together, so that in the middle districts of Scotland, at least, where this habit was the rule, it was impossible, on examining specimens, to say from what parentage they had sprung.

Dr. Stirton exhibited specimens of *Adelanthus Carringtoni*—a Jungermannia new to science, which he had found on Ben Lawers, and other places. This moss had formerly been confounded with *Alicularia compressa*, from which, however, it differs not only in the colour and areolation of the leaves, but also in their mode of attachment to the stem. It approaches much more closely *Alicularia occlusa* from Campbell's Island in the South Pacific; and as this last has been proved by Dr. Carrington to be an Adelanthus, it has been thought proper to refer this moss also to the same sub-genus.

The Rev. James E. Somerville then read a paper on *Danais Chrysippus* and its food plant, *Asclepias gigantea*, with illustrative specimens from Upper Egypt. The author of this paper gave a very interesting account of this butterfly from personal observations made during a three months' residence in Egypt, and also of the plants on which it is known to feed. He likewise described the peculiar properties of the *Calotropis Procera*, or *Asclepias gigantea* of Linnæus—a plant better known as the apples of Sodom—a beautiful series of which, in its various stages of growth, was exhibited by Mr. Somerville in illustration of his remarks.

Business being then concluded, the society adjourned till the last Tuesday of March.

MONTREAL NATURAL HISTORY SOCIETY.

January 31st.—The Rev. Dr. De Sola presiding. Professor J. W. Marsh, of Pacific College, Forest Grove, Oregon, was elected a corresponding member. The following resolutions, having been proposed by Principal Dawson and seconded by Rev. Dr. De Sola, were carried unanimously:—

"That this society, in presenting its medal to Sir W. E. Logan, LL.D., F.R.S., although it cannot add appreciably to the many honours which he has received, desires to place on record, not merely on its own behalf, but on that of all the students of natural science in Canada, its high estimation of the value of his services in creating as well as directing the geological survey of this country, in promoting the development of its mineral resources, in stimulating and aiding the efforts of scientific institutions, and in extending throughout the world the name of Canadian science.

"We desire also to express our high appreciation of Sir William's admirable qualities, and our hope that he may be spared for many years to Canada and to science, and that the relief from official cares may give him the opportunity to pursue to completion the researches in scientific geology in which he is now engaged."

Mr. Billings then read a paper "On the Occurrence of Gasteropoda (univalve shells) in the Primordial Zone."—He commenced by giving a short account of the discoveries that had been made in other countries, and then exhibited a fossil that had been collected during the last summer, by Mr. T. G. Weston, of the Geological Survey, in the Primordial slates, near St. John's, in New Brunswick. It was a small species of Ophileta, and its geological position was several thousand feet below the lowest beds in which any Gasteropoda had been heretofore found in America. The rocks were of the same age as the Lower Lingula Flags of Wales, the Menevian group of the late Mr. Salter. Another species, but of a different genus, has been discovered by Mr. Murray, in Newfoundland, in rocks which appear to be Primordial, but whose age cannot yet be determined with certainty for want of sufficient fossil evidence.

The chairman next called upon Professor Bell, of the Geological Survey, to read his paper "On the Intelligence of Animals."—The author spoke of the reasoning powers in many of the higher and larger animals as being too well established to require a plea, and devoted much of his paper to instances of what might be regarded as intelligence in such small creatures as insects. He adduced many arguments based on the organization and development of these animals, and more especially on their habits, for regarding them as possessed of something more than mere instinct. It was mentioned, amongst other proofs of the possession of a reasoning power, that insects, if baffled in one means of accomplishing their object, will generally try another; and that we find them as prompt and skilful in overcoming exceptional and artificial difficulties as in performing the ordinary duties of their lives. The habits of insects, like those of larger animals, appeared to be in a great measure the result of the accumulated experience of many generations. The term "instinct" has too general and vague a signification, and was often used as a convenient means of accounting for what we found it difficult to explain.

After the reading of this paper, several of the members present mentioned examples of animal intelligence, and an interesting discussion followed, in which Messrs. Billings, Whiteaves, Ritchie, and Drs. De Sola, Trenholme, Evans, and others took part.

BOSTON (U. S.) SOCIETY OF NATURAL HISTORY.

December 3rd, 1869.—The president in the chair, sixteen persons present. Dr. C. T. Jackson presented, in the name of Mr. Daniel McCain, specimens of native carbonate of magnesia from Greece, California, Maryland, and Kansas:—

That from Greece contains 99 per cent. of pure carbonate of magnesia, the rest, or one per cent., being silicious matter. The California specimen came from Alameda County, thirty-six miles from San Francisco. It is of the same degree of purity as that from Greece. The Maryland sample is rich enough for use, and contains 79·2 per cent. of carbonate of magnesia. The Kansas sample is very poor, containing but 8 per cent. of carbonate of magnesia.

These minerals are used by the Union Stone Company in making calcined magnesia, which is one of the ingredients of their artificial stone, serving, when combined with chloride of magnesium, as the binding material.

Dr. Jackson gave a detailed account of the method of making the artificial stone, and of casting bas-reliefs, busts, and ornamental mouldings. He said the processes had been so improved that now artificial grindstones made of quartz-sand and of emery had been constructed, which were as solid and durable as any natural stone. The emery wheels made of these materials are vastly better than those made with a paste of vulcanized india-rubber, since they do not glaze, but wear away in such a manner as to always expose fresh particles of emery. He regarded this new manufacture as of great value for architecture and the mechanic arts, and as showing the importance of the mineral native carbonate of magnesia, which had been before used only for the manufacture of Epsom salts, of which a limited supply only is wanted.

Professor N. S. Shaler offered some remarks on the relations of the rocks in the vicinity of Boston, of which the following is an abstract.

The association of the several different sets of beds which are exposed in the neighbourhood of Boston, is very difficult to determine satisfactorily; being nearly destitute of fossils, and extremely complicated by disturbances, they have not presented a very inviting field for research. They have consequently received, as yet, very little attention. I venture to offer here a few suggestions concerning their relations, which may serve as a basis for future communications, and for the study of those who may have the desire to examine the same field.

There can be no doubt that the syenites, which make up so large a part of the exposed rocks of eastern Massachusetts, are the oldest materials found in this region. The best exhibition of them, showing at once their general character and their relation to the superincumbent beds, is found in the immediate vicinity of Quincy, Mass. The extensive quarries of that neighbourhood enable us to see very well all the different conditions of occurrence of this rock. The most remarkable fact which has come under my observation is the existence of planes of separation in this syenite, which cannot be referred to joints. The three or more planes of joint-cleavings observable in these beds are clearly separable from this other set of planes which I cannot refer to any other cause than stratification, despite the opinion still generally entertained, that these rocks are of igneous origin, and owe their present structure to the actions which go on in a mass in a condition of igneous fluidity.[1] That I am not mistaken in referring these fractures to bedding is, I believe, abundantly proven by the details of structure of the syenite itself, as well as by the relations it bears to the unquestionably stratified rocks which rest upon it. These planes in question show none of the characters which are presented by the true joint planes and fault's planes. There are no slickensides. They are only imperfectly parallel, and of very varying thickness. There are visible on the surface of considerable sheets of this rock, laid bare in the Mitchell quarry near Quincy, splitting along what I believe to be the plane of stratification, markings indistinguishable in appearance from ripple-marks. This observation was made upon quite a small surface, so that it alone could hardly be trusted to determine the nature of these rocks. But upon the sides and the summit of the syenite, at various points, we find other evidence of their sedimentary character. If these syenites were of igneous origin, if they had been poured out before the deposition of the adjacent stratified beds, or thrust through them in a state of fusion, we should expect to find the usual marks of such actions. In the first of these cases the later sedimentary deposits would be found lying unconformably upon the syenite without any indication of transition; in the second we should expect to find a clear line of contact between the syenite and the sedimentary rocks, such as is always to be found where an intrusive mass of trappean matter cuts more ancient rocks. What we do find is that the imperfect bedding of the deeper portions of the syenite becomes more and more clearly defined as we pass towards the exterior of the mass, and gradually passes into unquestionably sedimentary rock. Every stage of this transition is not clearly seen, but enough is visible to satisfy any one that it really exists.

The first rocks, of quite unquestionable stratified origin, lie directly to the north of the Quincy syenite hills, and consist of clearly bedded sandstones, approaching quartzites in their character. These rocks have an unknown thickness, probably amounting to several hundred feet. Their general dip is northerly, with a variable angle of inclination which may be roughly averaged at twenty degrees. Above them the section is hidden for a distance which would give space for about three hundred feet of beds. Running the same north course across the break, we come upon the lowest of the Braintree series. This part of our section has a total thickness of about two hundred feet; its dip corresponds with the general inclination observable in the supposed stratification of the syenite, as well as that of the quartzites immediately above it. The whole of this Braintree series is fossiliferous, although it is only in about one hundred feet of the upper part that well-preserved specimens of the characteristic fossils are found. It is composed of beds which were evidently at the time of their formation very uniform mud of a sea-floor tolerably remote from land; and although much changed by metamorphic action it is easily perceived that the whole set of beds contains no trace of shore deposits. Immediately beyond the exposure of the Braintree beds at Hayward's Landing, a dislocation has brought the thin bedded quartzites again to the surface. The alteration in these is so great that the rock has assumed something of the appearance of gneiss, and would by some be classed in that group of rocks.

If there be no undiscovered faults in the section from the Quincy hills across the Braintree rocks in a north-easterly direction, the total thickness of unquestionably stratified beds is not far from 1,000 ft. The uniform dip away from the Quincy Hills, shown by all the stratified beds on their flanks, may be regarded as sufficient proof that their elevation came after the deposition of these beds.

The region about the Quincy Hills does not afford any sufficient evidence concerning the section above the line of the Braintree series. At Weymouth Landing there is a great mass of schistose rocks which certainly are not far removed from this part of the section, but I have not yet succeeded in tracing any connection with it. I am inclined to think that they may be the beds between the Braintree slates and the quartzites before described.

In addition to the rocks already mentioned, there exists two other sets of beds, which are extremely developed in the environs of Boston the relations of which are not easily determined. These are the series of the Roxbury conglomerate, and the set of beds which I have chosen to term, from the point where they are seen to the best advantage, the Cambridge slates. The first of these consists of a mass of stratified pebbles, with intercalated sandstones and grits, the whole capped by a series of ripple-marked sandstones about 100 ft. in thickness, and at certain points overlaid by masses of amygdaloidal trap. The total thickness of the formation remains yet a matter of question, but it cannot be less than 1,200 to 2,000 ft., and may be twice the latter amount. The whole is evidently a shallow water and shore deposit, being formed in a sea which became progressively more and more shallow, the uppermost beds affording evidence that they were deposited very near the shore.

The Cambridge slates show by their structure that they, like the Braintree slates, were deposited in deep water. In general character they resemble the latter rocks, being of dense argillaceous material, with little admixture of foreign substances, and presenting numerous planes of jointing, and one distinct cleavage along the line of stratification. The aggregate thickness disclosed in the Cambridge and Somerville sections is not far from 200 ft.; though owing to the fact that neither the base nor summit of the beds is observable, it is impossible to determine their depth. The only clear evidence of organic life consists in numerous but indistinct impressions of fucoids. A number of other peculiar forms have been found, but nothing satisfactory has yet been ascertained concerning them.

After several years of searching I have succeeded in finding a section which shows pretty clearly the relation of the Cambridge slates and Roxbury conglomerate. The most important part of this exposure has been uncovered by the extensive excavations now being made in the construction of the Chestnut Hill reservoir. In passing from the southern side of this reservoir in a nearly due north direction, we cross what seems to be a complete section of the slates and conglomerates of these two series of beds. On the south border of the lower reservoir at Chestnut Hill there is an outcrop of rocks in all important respects closely resembling the Cambridge slates. These are traceable for a distance of about 700 ft. in a northerly direction across the floor of the reservoir, having a nearly north dip at an angle of about 15°. Immediately above these and without any discordance comes the first of the conglomerate beds, which consists of a bed about 10 ft. thick of pebbles mingled with slates. This is surmounted by about 30 ft. of slates having a most perfect cleavage in the plane of stratification. It is not difficult to split a sheet a foot square having a thickness of not over $\frac{1}{50}$ inch. Immediately above this slate, which was evidently deposited in deep water, for it is remarkably uniform in its character, the conglomerate comes in again and continues with its northern dip at an average angle of about 15° for a horizontal distance of over a mile. Near the edge of the Charles River alluvial flats, in Brighton, this conglomerate changes suddenly into a sandstone which is throughout marked with very distinct ripple-lines, and bears other evidence of shallow-water origin. Above this sandstone mass there comes a great expanse of amygdaloidal trap, which at some points is seen cutting the sandstone and again appears to have been poured out over its surface as a contemporaneous sheet. As is often the case near great outbreaks of this kind, there are at least two faults, one on either side of the dyke, which have produced considerable dislocation in the beds. These are the only faults visible in this most interesting section.

Although it is by no means certain as yet, still it may be assumed as probable that the Cambridge slates and Roxbury conglomerate belong to the same great series of beds. The coincidence in the direction of dip as well as the general character of the beds themselves renders it probable that it may eventually be found that these slates and conglomerates form part of the same series of beds as the Braintree series, and all belong to the primordial era.

[1] The admirable researches of Dr. T. Sterry Hunt into the constitution and origin of granites and syenites have made it possible for the student to approach the question of the origin of rocks of these groups with a better chance of ascertaining the truth than would have been possible before the publication of the results obtained by them.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, FEBRUARY 21ST.—The correspondence was deposited by M. Dumas. It included a work by M. Chatin on the causes of the dehiscence of anthers.

Chemical and therapeutic experiments on the digestibility of amylaceous substances by the aid of a kind of diastase, by M. Bouterel.

A memoir, under seal, indicating means of recognizing some of the colouring matters used to adulterate wines.

A paper entitled "Researches on the domestic animals of ancient Egypt." Three species of antelopes, now wild, appear to have been domesticated in herds in the times of the ancient Pharaohs. Accurate drawings may even be seen on the monuments, showing the manner of fattening them, by ingurgitating their food in the way practised with fowls. It was in the time of the pastoral kings that these animals must have been allowed to have become wild.

M. St. Claire Deville made a few remarks on a new thermometer invented by M. Lamy. Ammoniacal chloride of calcium gives off gas which, in a closed space, possesses a tension which is directly related to the temperature. If, therefore, a meteorologist places on the roof of his house a small metallic box containing sufficient solution of calcium chloride saturated with ammonia, and connects it by a leaden tube with a manometer in his room, he can observe at any moment, without disturbing himself, the external temperature.

M. Faye having proposed to apply this instrument to the study of subterranean temperatures, M. Becquerel called attention to the fact that, five years ago, he had had constructed thermo-electric apparatus which perfectly fulfilled M. Faye's desideratum, and which act indefinitely without being touched, and which indicate the temperature to the twentieth of a degree.

M. Faye presented to the Academy a work by the Abbé Leray, on the explanation of universal attraction by movements of the ether. The idea is not new, but M. Faye thinks that the author has pursued it much farther than any of his predecessors.

M. Delaunay presented in the name of M. Simon Newcomb a new method for the development of the function of perturbation and its derivatives.

M. Prillieux sent in an interesting paper on the congelation of plants. He has established the existence normally of large icicles in the interior of all frozen plants. These icicles form small columns, perpendicular to the surface, and often penetrating the epidermis. The ice is formed from liquids derived from the cells. The cells themselves remain intact, so that there is no destruction, but simply a separation of organs, and therefore what has been said concerning the death of plants by freezing goes for nothing.

M. de Saint-Vénant read two reports, one on a memoir by M. Boussinesq relative to the propagation of waves; the other on the works of M. Tresca.

A new work was presented by M. Becquerel *père* on the physico-chemical phenomena of the organism. He, in the first place, explained the continuation of his researches on the osseous current which represents the electro-capillary currents, to the action of which he refers the nutrition of the bones; and then considered the mode of intervention of the physico-chemical forces in the nutritive functions of the encephalon and of the nervous system.

M. Cahours read a report on the works of M. Houzeau on ozone. In this report, M. Cahours asks in the name of prudence for some certain reaction, possessed by ozone only, by which to recognize its presence, inasmuch as that, when it exists, it can scarcely have been formed under any other circumstances than those that would give rise to oxygenated water (peroxide of hydrogen) and the oxides of nitrogen.

MM. Boussingault and Wurtz thought M. Cahours over-prudent. They had no doubt of the existence of ozone in the air, and they considered its characteristic smell to be its best test.

M. Wurtz presented a work by himself, and stated that, wishing to prepare alpha-toluilic acid by the method he had given for passing from the carbides to the superior acids, he obtained, instead of this body, a compound much more complex.

M. Wurtz then presented a work by M. Pollet on the action of chloride of acetyl on glucose. This chemist has obtained a body in which five atoms of hydrogen in glucose are replaced by four of acetyl and one of chlorine. This sugar must, therefore, be considered as a pentatomic and not hexatomic alcohol, as it has been hitherto held to be.

Some curious experiments were also cited by M. Wurtz, of M. Liebreich, on chloral. From these experiments, as yet incomplete, it would appear that chloral and strychnine nitrate are antidotes for each other.

SOCIÉTÉ PHILOMATHIQUE OF PARIS.

PARIS, JANUARY 22ND.—At this meeting, which we have in part reported already, M. Ribaucour made a communication on the theory of surfaces, a purely mathematical paper.

M. A. Laussédat read a paper on a graphical method suitable for constructing maps, which will indicate eclipses of the sun for the earth generally. The method pursued by the author is that of which the astronomers of the last century made use, modified so as to increase its precision. This method was conceived by the author a long time before he became aware that it had been imagined by the celebrated geometer Lambert. It is a transformation of the orthographic into the stereographic projection, and the author believes it has not before been usefully applied.

ROYAL ACADEMY OF BELGIUM.

BRUSSELS, JANUARY 8TH.—The correspondence included several sheets of the geological map of the Netherlands from his Excellency Baron L. Gericke, in the name of the Government of Pays-Bas. (1) Meteorological observations made in the year 1869 at the Royal Observatory of Brussels, at Ostend, by M. Cavalier, and at Liége by M. Leclercq; (2) Botanical observations made at Namur in 1869 by M. Bellynck; (3) Observations on the animal kingdom made at Melle in 1869 by M. Bernardin; sent in for the report on periodical phenomena.

A list from M. Altenrath of the storms which he had observed in Anvers during the year 1869.

The following memoirs were received, and will be made the subject of reports:—

1. Materials for the Fauna of Belgium — terrestrial isopodous Crustacea, by M. Félix Plateau.

2. Researches on the Embryogeny of the Crustacea: (IV.) Development of *Anchorella*, *Serneopoda*, and *Hessia* (E. van Ben.), by M. E. van Beneden.

3. Description of a new African species of the genus *Varan* (Varanus), by M. Preudhomme de Borre.

4. Note on the nature of the sun, by M. G. Benaerts.

5. Discovery of a bed of phosphate of lime beneath the town of Louvain, by M. G. Lambert.

M. Stas was elected director for 1871 and M. Dewalque was installed in the same office for the present year by the retiring director, M. Nyst.

Reports by MM. Spring and Coemans were then read on a note by M. Kickx, on the reproductive organ of *Psilotum triquetrum*, Sw. In conformity with the conclusions of these reports, the paper was ordered to be printed in the *Bulletin* of the Academy.

M. Gluge gave a verbal report on two notes by M. Robin, one on the means of foreseeing the comparative size of the males and females in the animal series, and the other, relating to the effects of lightning on animals.

M. Quetelet communicated a note on the Aurora borealis of January 3rd, 1870.

THE VIENNA ACADEMY.

VIENNA, JANUARY 13TH.—At this meeting, which should have been reported in our last number, instead of that on January 22nd, Dr. von Scherzer, at the head of the commercial department of the East-Asiatic expedition gave an account of the things obtained in China and Japan. Among these were (1), three Chinese skulls (two from Hongkong, the third from Peking) and three Japanese skulls (two from Osaka, the other from Jeddo), which had been sent by permission of the Government to the Anatomical Museum of the Vienna University; (2) a small but very interesting collection of fresh-water fishes from Osaka (Japan), made over by the Government to the Academy; (3) a collection of works on medicine in the Japanese tongue; (4) a number of Chinese drugs, collected with great care and skill by Dr. Kerr. Of this collection, the Government have been requested to allow a part to be placed at the disposal of the medical faculty for pharmacological and physiological experiments; (5) a large collection of Chinese philosophical works, 116 volumes in all, sent by the Chinese Government in return for the works taken out and presented by the expedition; (6) a similar present from the Japanese Government.

Herr W. von Haidinger gave the contents of a series of brief communications made to him concerning the pre-Homeric fall of two meteoric stones at Troy, by Professor W. Hallows Miller, For. Sec. R.S.

Dr. Emil Weyr sent in a paper on curved pencils (*Curvenbüschel*).

Herr Anton Waszmuth sent in a memoir on a new method for determining the reduction-factor of a tangent galvanometer.

Dr. Reuss presented a memoir entitled "Upper Oligocene (*Oberoligocäne*) Corals of Hungary." It contains the description of corals from beds, hitherto held to be eocene, of the tertiary formations of Mogyoros, Tokod, Dorog, Bayóth, in the vicinity of Gran, in Hungary.

Professor Langer presented a memoir by Dr. Leo Levschin, containing the description of the structure and vascular relations of the intestine of *Salamandra maculata*.

Herr Franz Unferdinger presented a memoir on the transformation and determination of the treble integral

$$fff\,\mathrm{F}\left(\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}, \alpha x+\beta y+\gamma z\right)dx\;dy\;dz,$$

three conditions being assumed.

The next paper was by Herr Obersteiner, on some lymphatic cavities in the brain.

Dr. S. L. Schenk presented a paper on the nitrogen in flesh.

ROYAL INSTITUTION OF LOMBARDY.

MILAN, JANUARY 13TH.—The three following memoirs were received :—The fundamental principles of intelligence, by Professor Carlo Cantoni; on the influence of coloured rays on respiration, by Signori Selmi and Piacentini, presented and read by Dr. Strambio; on the practical and scientific Epicurism of the Romans, by Professor Ivo Ciavarini.

Dr. Maggi made some brief remarks on Professor Ciavarini's paper, to which the author replied.

Professor Schiaparelli then read a note, by Professor Serpieri, on the form of the radiation from the Perseidæ of August meteors," and also presented a work by himself entitled, "General observations on the form of meteoric radiations."

Professor Baldassare Poli, read a short note on obligatory and gratuitous elementary instruction.

Drs. Verga and Valsuani presented their work on the therapeutic uses of chloral.

The meeting then proceeded to consider proposals for the coming election of Italian and foreign corresponding members. It also decided to exchange publications with the Italian Geographical Society.

The examination of an evaporimeter presented by Signor Antonio Frascoli was then referred to a commission consisting of Signori Cantoni, Hajech, and Schiaparelli; and the examination of a stove for hatching silkworms' eggs proposed by Signor Orlandi.

To Professor Casorati was intrusted the task of examining an elementary treatise on mathematics and mechanics; an unprinted work submitted to the judgment of the Institution by the Rev. Francesco Bertolini.

Several officers were then re-elected, and the meeting terminated.

NOTES AND MEMORANDA.

Lectures at the Royal Institution.—A course of four lectures on meteorology was delivered by Robert H. Scott, Esq., Director of the Meteorological Office, commencing on Saturday, January 22nd. The lecturer stated that the science was too much in embryo at present to justify weather prophecies on a sweeping scale. Within the limits of forty-eight hours he thought conjectures might be made with some amount of reliability. The tracings and drawings exhibited were clear and comprehensible. Six lectures on the architecture of the human body were given by George Murray Humphry, Esq., Professor of Anatomy, Cambridge. The lecturer said that the human body furnished an argument in favour of development going on in different places at the same time. He endeavoured to show that this theory would hold good also with regard to the natural kingdoms. The analogies existing between the members of the body and the species on the globe were not dwelt upon by Professor Humphry. The first two of Professor Max Müller's lectures on the science of religion have been given—on Saturday, February the 19th and 26th. The drift of the argument seems to be the establishment of a parallelism between languages and religions. The lecturer would enhance his subject by giving his audience less to infer at times. Quoting Goethe, he said, that the man who knew but one language knew none. We are to understand that he or she, as the case may be, who knows but one religion is in the same predicament. It was also stated that the followers of great originators were apt to swear to miracles having been performed by these prophets, who, after their decease, had not the power of repudiating such statements in the clear and efficient manner in which they had done so during their lifetime. Is this statement applicable to the Testament religions. If Professor Max Müller thinks so, why not say so? Most, or rather all, religionists, he says, think their doxy the only correct one, and abuse or disregard others accordingly. Will the science of religion in Professor Max Müller's hands disclose the virtues and shortcomings of all alike?

How many Lepidoptera are there in the World?—This question is thus answered by Mr. Bate in his able address to the Entomological Society:—In the *Stettiner Entomologische Zeitung* I find a very readable paper by Peter Maassen, of Elberfeld, on a subject which will be interesting to most entomologists. It is an attempt to compute the total number of species of Lepidopterous insects existing in nature, and is written in correction of a previous crude essay by Keferstein on the same subject. In his estimate the author takes for his basis the curious fact that in all complete lists of local Lepidopterous faunas in Europe the number of moths to butterflies is as 26 to 1. He then gets at the probable number of butterflies in existence, by arguing from the number published, districts unexplored, and so forth, and believes the number to be not fewer than 8,740. Unfortunately, in pursuing the calculation he forgets his datum-line of 26 moths to 1 butterfly, and takes the proportion as it stands in Staudinger and Wocke's *Catalogue of European Species*, where the proportion of course is much less, because the smaller moths have not been so exhaustively collected throughout Europe as the butterflies. In this way he arrives at the total number existing in the world as 129,740—a surprising amount, but still far below the truth if the proportion found in well-worked districts in Western Europe is maintained throughout the world, which would produce the incredible total of 227,240 species.

Oxygen Manufactured on the Large Scale.—The works for this purpose are at New York, and consist of retort-houses, engine-rooms, store-house, pumps for compressing gas in cylinders, and a gas-holder of 26,000 cubic feet capacity. Mr. Morton's process is carried on as follows:—About 700 lb. of manganate of soda are placed in a retort and heated to the requisite degree; superheated steam from a boiler is then admitted for about ten minutes. Two equivalents of the manganate of soda, and two of water, react upon each other, in this way:—The water combines with the soda of the manganate, to form a hydrate of soda, the manganic acid is converted into sesquioxide of manganese, containing only half the proportion of oxygen, and the other half of the latter passes off in the free state. At the conclusion of this part of the process, the steam is shut off, and the superheated air is admitted for about fifteen minutes whereupon the sesquioxide combines with more oxygen from the air, and is reconverted into manganic acid, which again combines with soda. The retorts in each furnace are charged with 700 lb. of permanganate of soda, and by the consumption of two chaldrons of coke, and with the labour of three men, 25,000 cubic feet of oxygen are made per day. It is now sold at 5 cents (2½d.) per cubic foot, compressed in reservoirs up to a pressure of 250 lb. to the square inch. The gas is of excellent quality and very pure.—*Journal Franklin Institute*, through *Chemical News*.

Salmon Propagation.—During the past spawning-season the Stormontfield Salmon Propagation Breeding-Ponds have been stocked with about 465,000 salmon ova, being about 100,000 more than in any former year. In course of the operations at Almond mouth spawning-beds, says the *Farmer*, 184 male and 134 female salmon and grilse, were landed. The ova were procured from 57 female fish, Ten clean salmon and grilses were landed; as also a number of clean sea trout. In the stomach of a yellow trout caught were found between 300 to 400 salmon ova. The operations in connection with the Stormontfield Ponds commenced on the 22nd November and concluded on the 27th December last, owing to the Tay being at a too low level to permit more fish coming forward to the spawning-beds. In consequence of the long continued frost of the present winter the hatching process in the ponds is not in so forward a state as in some recent years; yet, notwithstanding the severe weather since the commencement of the year, a good many of the first deposited ova are manifesting signs of life. It may be added that if the spawning-season had been as favourable as was at first anticipated, it was intended to have deposited in the Stormontfield Breeding-Ponds upwards of 800,000 ova.

Fixative for Drawings.—Correspondents, says the *Builder*, ask us, from time to time, the way to set pencil and charcoal drawings. We have just had an opportunity of testing an invention by M. Rouget, one of the masters of the Government schools in Paris, for "permanently and instantaneously fixing every kind of fugitive design, such as those produced by chalk, crayons, pastels, lead pencils, or other similar materials." It consists of a liquid which is blown through a little glass apparatus, in the shape of a minute shower that spreads itself over the paper, so that the drawing is not rubbed by a brush being passed over it. Through the fineness of the spray the paper is not cockled, neither does the liquid appear to leave any mark. Our test was severe, and upon rubbing the drawing operated upon with india-rubber, nothing moved, nor was any appearance of a smear produced. It seems a very valuable preparation. According to the London agents, Corbière & Son, it is equally efficacious with photographs.

Iron and Steel Crystals.—M. Schott, of Ilsenberg, has made many microscopical examinations of the structure of steel and iron. He maintains that all crystals of iron are of the form of a double pyramid, the axis of which is variable, as compared with the size of the base. The crystals of the coarser kinds, as compared with those of the finest qualities of crystalline iron, are of about twice the height. The more uniform the grain, the smaller the crystals, and the flatter the pyramids which form each single element, the better is the quality the greater is the cohesive force, and the finer the surface of the iron. These pyramids become flatter as the proportion of carbon contained in the steel decreases. Consequently in cast iron and in the crudest kinds of hard steel the crystals approach more the cubical form, from which the octahedron proper is derived, and the opposite extreme or wrought iron has its pyramids flattened down to parallel surfaces or leaves, which in their arrangement produce what is called the fibre of the iron. The highest quality of steel has all its crystals in parallel positions, each crystal filling the interstices formed by the angular sides of its neighbours. The crystals stand with their axes in the direction of the pressure or percussive force exerted upon them in working, con-

sequently the fracture shows the sides or sharp corners of the parallel crystals. In reality, good steel shows, when examined under the microscope, large groups of fine crystals like the points of needles—all arranged in the same direction and parallel.—*Journal of Applied Chemistry.*

SCIENTIFIC DIARY.

WEDNESDAY, March 2nd.

Society of Arts, 8 p.m. "On Tramways in Streets," by W. Bridges Adams, Esq.
Pharmaceutical Society, 8 p.m.
Yorkshire Naturalists' Club, 8 p.m. "On the recent Deep Sea Dredgings," by W. Procter, M.D., F.C.S.
Obstetrical Society, 8 p.m. Adjourned Discussion on Dr. Braxton Hicks's paper "On Puerperal Diseases." "Two Cases of Eclampsia successfully treated by Chloral," by Baron Paul von Seydewitz, M.D. "Cases of Bilocular Uterus," by Dr. South and Dr. Rogers. "Two Cases of Twins, in which, while the first Child presented naturally, there was Placental presentation with the second," by Dr. Brunton.

THURSDAY, 3rd.

Royal Society, 8.30 p.m. "Results of Monthly Observations of Dip and Horizontal Force made at Kew Observatory," by B. Stewart, F.R.S. "Spectroscopic Observations made with the great Melbourne Telescope. On the Nebula in Argo, and on the Spectrum of Jupiter," by A. Le Sueur.
Society of Antiquaries, 8.30 p.m. "On Monastic Inventories," by the Rev. M. E. C. Walcott, B.D., F.S.A.
London Institution, 7.30 p.m.
Linnean Society, 8 p.m. "Hybridism among Cinchonæ," by Mr. J. Broughton.
Chemical Society, 8 p.m. "Indices of Refraction," by Dr. Gladstone.
Royal Society Club, 6 p.m.
Society of Artists and Amateurs, 8 p.m.
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.
Harveian Society, 8 p.m. "On the Functional Disorders of the Male Generative Organs," by Mr. J. Teevan.
Pathological Society, 8 p.m. The following Specimens will be exhibited:—"Gangrene of Femoral Vein, with Perforation of the Artery," by Mr. Gay. "Tubercular Meningitis in connection with a Caseous Formation," by Dr. H. Weber. "Subperiosteal Hæmatoma of Orbit," by Mr. Hulke. "Paralysis with apparent Muscular Hypertrophy," by Dr. Langdon Down. "Disease of Knee-joint," by Mr. Carr Jackson. "Aortic Aneurism," by Dr. Robinson.
Leamington Microscopical Society, 8 p.m. "Entomology as Illustrated in the Microscope," by Mr. J. S. Baly, F.L.S.
Bradford Philosophical Society, 8.15 p.m. "On Art and Art Schools," by Mr. Lockwood.
Perth Society of Natural Sciences, 8.30 p.m. Annual meeting.
Leeds Philosophical Society, 7.30 p.m. Mr. Huggin's Second Lecture.

FRIDAY, 4th.

Geologists' Association, 8 p.m.
Philological Society, 8.15 p.m. "Attempt to reconcile the Laws of Latin Accent and Rhythm with those of Modern Languages," by Prof. T. Hewitt Key.
Royal Institution, 8 p.m. "Iron-built Ships," by Mr. Reed.
Archæological Institution, 4 p.m.
United Service Institution, 3 p.m. "Ocean Currents and their Influences," by Mr. A. G. Findlay.
Western Medical and Surgical Society, 8 p.m. "On the Modern Treatment of Syphilis," by the President (Mr. J. R. Lane).

SATURDAY, 5th.

Royal Institution, 3 p.m. "Science of Religion," by Prof. Max Müller.

MONDAY, 7th.

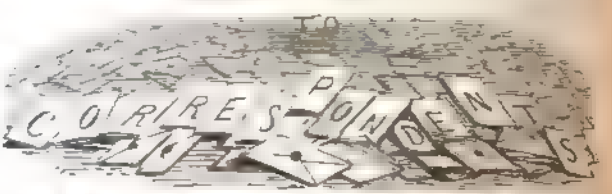
Entomological Society, 7 p.m.
Medical Society of London, 8 p.m.
Victoria Institute, 8 p.m. "A Demonstration of the Existence of God," by the Rev. Dr. McCann, of Glasgow.
London Institution, 4 p.m.
Society of Engineers, 7.30 p.m. "On the Friction in the Steam Cylinder," by Mr. Peter Jensen.

TUESDAY, 8th.

Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m.
Photographic Society, 8 p.m.
Ethnological Society, 8 p.m.
Liverpool Anthropological Society, 8 p.m. "What is Man?" by Dr. Hitchman.
Royal Institution, 3 p.m. "Plant Life," by Dr. Masters.
Manchester Literary and Philosophical Society, 7 p.m.

WEDNESDAY, 9th.

Society of Arts, 8 p.m.
Geological Society, 8 p.m.
Graphic Society, 8 p.m.
Microscopical Society, 8 p.m. The following papers will be read by W. B. Carpenter, M.D., F.R.S., &c.:—"On the Comparative Steadiness of the Rose and Lister Models under trying circumstances." "On the Shell-structure of Fusulina." "On the Micropyle of the Fish's Ovum." "On the Separation of the Spines of Echini."
Royal Literary Fund, 3 p.m.
Royal Society of Literature, 4.15 p.m.
Archæological Association, 8 p.m.



THE SCIENCE OF RELIGION.—"Dr. H." We quite agree with you that the coincidence is peculiar: but we do not think it merits a note specially directed to it. It is very questionable, Mr. Max Müller notwithstanding, whether there is such a thing as a science of religion.

NATURAL HISTORY SOCIETY OF GLASGOW.—We beg to thank the secretary for his communication.

TRANSIENT HEMIPLEGIA.—"M. R." The letter appears. The subject is one of high physiological interest and importance.

PROFESSOR KJERULF'S ESSAY.—Sir Charles Lyell's note has been received. His desire shall be attended to.

LIVERPOOL SOCIETIES.—Our esteemed correspondent is thanked for his kindness. "Copy" in hand.

ASTRONOMY AND "COMMON SENSE."—"J. H.'s" communication has reached us. We quite agree with him that the ignorance of astronomy shown by some folk is a national disgrace. We are glad that "J. H." has realized this important fact. Has "J. H." found his "level"?

AN ELECTRIC VANE.—"H. G." should send us the communication and blocks if he wishes us to take notice of it. We doubt not the point is of interest. Please insert the correction in the copy you send us.

MELBOURNE PUBLIC LIBRARY.—"A. T."—The letter of the trustees has just reached us. Thanks.

BATTERY FOR ELECTRO-GILDING.—"R. T."—We fear there is no good book in English. Indeed, many of the most important modifications are trade secrets. Apply to Mr. G. Gore, F.R.S., Edgbaston, Birmingham. Also consult Ure's *Dictionary of Manufactures*.

SOCIETY OF ARTS.—"W. L. W."—The letter has been received and it appears.

WOOLHOPE TRANSACTIONS.—"T. T. S."—It is acceptable. Send it regularly. Received too late for this number.

DIA-MAGNETISM.—"P. R." You should wait till Dr. Tyndall's new work appears. It will be published by Longmans, and is now in the press. It is entitled *Researches on Dia-magnetism and Magne-crystallic Action*.

QUEEN'S COLLEGE, GALWAY.—"B." We think a gross injustice has been done. We shall probably refer to the matter in an early issue. The medical department *most unquestionably* needs reform. We think Mr. Melville was rash in his mode of expression; but, substantially, we are disposed to think his opinion of the clinical department is correct.

JERMYN STREET MUSEUM.—"Felspar."—We did not send you a proof because the "copy" was so very legible. We believe you will be satisfied with the result. The persons you mention are very likely to put the staff to its "purgation." Existing interests, however, should not be interfered with. Some of the lecturers are too badly remunerated as it is.

SIR W. THOMSON *versus* GEOLOGY.—"P. S. M."—Your letter has just reached us. Send the MS. as soon as you can. We thought our predictions would be realized, but are sorry to find that it is so. Send a notice of the essay if it touches on the problems in question. We will see about Mayer's paper. The general opinion of Mayer is as you say.

GEOLOGICAL SOCIETY.—"A Friend" has our best thanks. Even philosophers must earn their bread. We feel disposed to speak like the fox-hunting lawyer in the farce of the *Irish Attorney* when addressing his clients, he says, "there are, gentlemen, high-ways and by ways, straight ways and crooked ways, and, as in the case of your landlord, exceedingly dirty ways."

DEMONSTRATING OPHTHALMOSCOPE.—"M. D."—Use Liebreich's instrument. The so-called binocular is not of much use.

MAGNESIAN LIMESTONE.—"Geo."—No. The process is kept a secret as far as possible. It is, nevertheless, one which would occur to any intelligent chemist.

DINORNIS.—"H. C."—There is every reason to believe that the animal existed at no less recent a period than that of the direct ancestors of the present Maories.

THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, MARCH 9, 1870.

THE ROYAL SCIENCE COMMISSION.

IT is now a month since we commented on the subject of the deputation which presented itself to the Lord President of the Council and asked for a Royal Commission to inquire into the manner in which Government aid is now extended to Science. We then forbore to point out the singularly infelicitous manner of a deputation no two of whom were agreed as to the demand they desired to make, and none of whom gave any satisfactory sketch of the present relation between Government and Science. We refrained from doing so, in the interests of Science, because we hoped that a Commission would ultimately be afforded, and we feared that if we indicated the somewhat Hibernian manner in which the deputation expressed its views, we should be doing that which would help to make the deputation seem in the eyes of the public, as it must have in the eyes of the President of the Council, not a little ridiculous.

Our best hopes have been at length realized in the reply which Mr. Forster gave in the "House" last night to Mr. Samuelson's question. We mean that so far as we desired a Commission to investigate the present condition of State-aid to Science, our wishes have been fully gratified. This qualification becomes necessary, because Mr. Forster's answer is not limited to the promise that Earl de Grey will advise her Majesty to issue a Commission, but goes on to state that "the question of the amalgamation of the Jermyn-street and Oxford-street Schools with the new School of Science at South Kensington will come within the scope of the inquiry." The consideration at this early period of the particular duties of the Commission is at least a little premature, and almost looks as though the machinery of Commissioners was being employed by certain notorious and skilful wire-pullers to compass special ends of their own. Thus it is that, while we rejoice at the step which our Government is about to take, our gratitude is flavoured with the slightest *soupçon* of suspicion that the gift may in some slight degree owe its origin to the "Greeks," and that it is to be feared accordingly.

We do not like to be told, in the same breath that we learn of the projected issue of a scientific *lit de justice*, that the case is so far prejudged already that certain issues of a definite character are in the contemplation of the Government. But, after all, are not scientific men themselves to blame, when, without unison or agreement of any kind as to the task which a Commission would have to achieve, they go before the authorities merely, as it were, to illustrate the saying—"Quot homines tot sententiæ"? Can we be surprised that the Ministry, having in vain sought for a unanimous opinion from the leading *savants* of the country, has at last asked the advice of some of its own immediate counsellors, and with consequences that may, if not counteracted, be most damaging to Science?

It is high time that something were done to ascertain the views of the chief scientific teachers throughout the kingdom as to the manner in which the new Royal Commission should collect its evidence. This may perhaps seem a trivial suggestion to those unfamiliar with Parliamentary matters, but to those who know anything of the conduct of Commissions of Inquiry, of the immense mass of useless evidence which is taken, of the want of discrimination in the selection of witnesses, of the meddling and muddling of *dilletanti* outsiders, and, lastly, of the unpractical and often absurd conclusions which are ultimately laid down, the necessity that scientific men should at once take counsel together is gravely apparent.

The names of some of those who are to be appointed Commissioners are even now mentioned unofficially, and certain of them are those of men on whose patience and judgment we can thoroughly rely. We would, however, urge on the Government—notwithstanding our conviction that a small and workable Commission would be the best suited to the emergency—to select for the inquiry men who not only represent the most advanced schools of Science, but who are also sufficiently familiar with the requirements of education, and who above all, have not been mixed up with political science, if we may so term it. There are not a few otherwise "representative men" in the country whose whole lives have been spent, not in scientific research, for they gave that up years ago, but in the lobbies of the House, and whose existence is conditioned by successful political jugglery to their own ends and advantages. "The Lord deliver us," as the Protector would have said, from a Science Commission which even numbered some of these champions of "Applied Science." They are the "ravening wolves" of Science, who now and then come down on the fold of the weaker, but honester and more useful, workers in the great field, and devour them, or rather the funds which they would fain employ in the best interests of Science. We will not mention names; but we doubt not that, on the old principle of "a word to the wise," the Government, if warned in time, will avoid the political pedlars of the kind we refer to.

Should the Commission be well constituted, a great point will have been gained. But this will not suffice. It must not be left to the Commission, unadvised, to "take evidence" indiscriminately. Some expression of opinion on the part of scientific men will be necessary, or else both time and money will be uselessly expended. It is essential to the safe conduct of the investigation that several matters at present obscure be made clear. Firstly, it is required to know how the money now given to Science is laid out. This is, we believe, Professor Huxley's suggestion, and it is a most excellent one. Till we know this, nothing practical can be effected. But when this is settled, then there will come the question as to the way in which Government aid should be applied? Should the funds be wholly made over to schools engaged in the dissemination of scientific knowledge, or wholly appropriated by those who are engaged in original researches calculated to advance the material, as distinguished from the intellectual, wealth of the nation? or, finally, should it be divided between these two sections? And even when these points are decided, there will still be the terrible problem of the method. On the last of these questions the Commission will, we trust, supply us with information But the first, we should think, ought immediately to receive some consideration and discussion, so that the path of the Commission may, as it were, be roughly sketched out.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

MUCH as we respect M. Leverrier for his great genius, we cannot but think that the announcement that M. Delaunay is his successor will give general satisfaction to astronomers. A French scientific contemporary congratulates the moon on M. Delaunay's appointment. This is at best a poor joke. M. Delaunay's recent great services to the science of the geology of the centre of the globe, show him to be a thinker whose ideas are not confined even to the very wide field of astronomical investigation.

At the meeting of the Literary and Philosophical Society of Manchester last night, Sir James Cockle, M.A., F.R.S., president of the Queensland Philosophical Society, was elected a corresponding member.

Mr. Cooper, the explorer who started to travel into China from India, by way of Assam, has been compelled to return. He was stopped on the Thibet frontier.

We are very sorry to have to announce the severe illness of Professor Agassiz. The Professor has been advised by his medical attendant to refrain from mental work of all kinds, and it is believed that he is suffering from cerebral or spinal disease of a grave character. Hopes are, however, entertained of the Professor's ultimate recovery.

Silk cultivators will be glad to learn that M. Pasteur proposes this year to carry out an elaborate series of experiments on the subject of silkworm growth, health, and nourishment. These experiments will be carried out on an estate of the Prince Imperial, situate between the Gulf of Trieste and Carnero.

The new building of the University of London will, we believe, be opened by her Majesty in person. The ceremony will probably take place in May or June.

Science has suffered a deep loss in the death of Professor Unger, of Gratz, the well-known botanist and palæontologist. This eminent *savant*, who has for some time laboured under a combination of sciatica and chronic rheumatism, was found dead in his bed on the morning of the 13th ult. He had reached the age of seventy years. Some of his more remarkable works are those in which he has sought to point out the resemblance between the plants of Tertiary deposits in Europe and the existing vegetation of Australia.

With reference to the "Galvanoscopic Lantern" described in our last week's number, a correspondent informs us that such a lantern was used by the Astronomer Royal a year ago, in some lectures on Magnetism at the Cambridge University, and is being used at the present time by Mr. Airy in a course of lectures which he is delivering at the South Kensington School of Naval Architecture upon the same subject, but with special reference to ships' compasses. Mr. Airy projects the image of a magnetic needle upon the ceiling of the lecture-room, or upon a horizontal instead of a vertical screen. This is the only difference between his construction and Mr. Smith's.

It is with much satisfaction that we are able to announce that Dr. Henry Maudsley has been appointed to the Chair of Medical Jurisprudence in University College. This professorship has long been vacant, and we believe that it was kept open because of the disqualification of some of the candidates. In Dr. Maudsley, however, the Council has found a teacher who, we believe, will shed lustre on the medical school, and will be most popular among his pupils. Dr. Maudsley has not, we believe, given much attention to toxicology, but his wide range of knowledge on mental diseases, and his experience as a teacher in St. Mary's Hospital, sufficiently attest his claims to the post he has obtained.

At Messrs. Puttick & Simpson's sale last week, two valuable autograph letters of Descartes were sold for £11. 2s. 6d.

The Vienna International Exhibition Committee have decided that, in the event of the proposal of charging foreign countries with the cost of the buildings in which their productions are exhibited being abandoned, each exhibitor should be required to pay rent for the space he occupies. The probable cost of the undertaking will be 6,000,000 florins (£600,000).

We can only wonder that the question which Mr. Reed is to ask in the House on Friday was not asked before. The following is the Oxford University expression of the monstrous advantages which wealth and birth obtain over mere genius in institutions which are supposed to be established for the promotion of learning only:—"Privileged students are these: all peers, all sons and the eldest sons of all eldest sons of peers and of peeresses in their own right, all baronets, and the eldest sons of all baronets and knights. All such students, if matriculated as such, and not on the foundation of any college, may be admitted to the degree after eight terms' residence, yet not till their twelth term. A Bachelor of Arts can proceed to the degree of Master in the twenty-seventh term (if privileged, in the twenty-third) from his matriculation." Mr. Reed's question is, whether the Government mean to allow this absurd state of things to continue.

In connection with the subject of university education we are glad to see that Mr. Fawcett will, next month, move the consideration of the memorial from the Provost and Fellows of Trinity College, Dublin, in favour of undenominational education; and also for an undenominational distribution of emoluments, distinctions, and degrees. Truly, we are in a hopeful age, and we are being legislated for by a "reformed Parliament." Are the Irish to have at length something in the shape of a "National University," as some time ago proposed by the member for Brighton?

Those who are interested in American entomology will be pleased to learn that the *First Annual Report of the State Entomologist of Missouri* can be had, without plates, by sending fifty cents to C. W. Murtfeldt, Secretary of the State Board of Agriculture, 612, North Fifth-street, St. Louis.

About 1,200 persons attended the brilliant *conversazione* given on Tuesday week last at the Royal Dublin Society. Among the most interesting of the collections were a number of dietary articles in various stages of solution with the aid of pepsine.

Secretaries of local boards are requested by the Society of Arts to notice that candidates desirous of being examined in musical composition, holding the Tonic Sol-fa Association certificate of "Honourable Mention" in musical composition, and the member's certificate of "General Musical Culture," need *not* undergo the preliminary examination.

The Medical Society of New York offers two good prizes for essays on medico-physiological subjects. At the last meeting it was resolved that the Publication Committee announce, through the medical journals of the State, the prize offered by Dr. Corliss, viz., one hundred dollars for the best essay on the cause, prevention, and cure of tuberculous phthisis; and that they also announce, at the same time, a prize of one hundred dollars from the Merrit H. Cash fund for the best essay on any medical subject; such essays to be submitted to the Prize Essay Committee on or before the 1st day of December next, and subject to the regulations adopted by the Society.

In a recent number we recorded a statement made by some of our scientific men in regard to the influence of hard and soft water on the people, and we pointed out the danger of such generalizations. In connection with this matter, it gives us much pleasure to quote the following remarks made in a letter to Saturday's *Chemical News*, and which we fully endorse:—"The *Spectator* said, last week, that 'it seems as if no class of men drew rasher or hastier conclusions than the men of science.' This was *à propos* of a recent statement as to the effect of hard and soft water upon the human constitution. Now I should very much like to know who originated this statement. Surely, if a physician, he could not have been a chemist, and, if a chemist, no physician. The *Spectator*, generally intelligent and well-informed, persists, like the *Times*, in speaking of druggists as chemists, and probably shares, too, the popular opinion that a doctor necessarily knows all about analysis and the arcana of chemical science. The investigation of the present case will, I feel confident, result in showing that the rash and hasty conclusion complained of was not drawn by a genuine man of

science competent to connect a chemical fact with a physiological phenomenon. There are too many *fungoid* or pseudo-scientific men, who seize upon the results of true philosophers, and misinterpret them to the popular theme."

"TRANSFUSION" is a surgical operation of so rare and interesting a nature that it is pleasant to be able to record a successful instance of its performance. It is attempted in cases when, from great loss of blood, a patient is almost *in articulo mortis;* and it consists in drawing blood from some one who can spare it, and injecting it into the veins of the dying person. In the case to which we have alluded, and which occurred the other day in Dublin, a lady was dying of uterine hæmorrhage; ten ounces of blood were taken from her husband and injected into her veins, and the result was most successful.

Is the negro exempt from delirium tremens? This is a curious question, but one which has been seriously asked. At a meeting recently of one of the American scientific societies, Dr. Staats asked a question in reference to the fact as to whether delirium tremens ever occurs in the negro. Although having treated in the Albany Penitentiary fully four hundred cases of disease in negroes, he had failed to meet with a single one of *mania à potu*. In reply, Dr. Graves remarked that he had met with two cases in the negro; Dr. Sherrill had seen one, Dr. Hun two, and Dr. Stiles one.

SURELY, if a Royal Commission is required to investigate the system of scientific education in this country, one is still more required to examine into the methods of medical education so diverse and conflicting, so numerous and costly. Yet—admirable proof of its selfish policy—the General Medical Council has neglected and thrown over the excellent proposal to have a commission of inquiry, put by Sir D. Corrigan and seconded by Dr. Rumsey. This effete, expensive, garrulous, and useless body very cunningly sees in a Royal Commission the *coup de grâce* to its own existence. Hence its wisdom!

WE are informed that two tons of silkworm eggs lately passed on the Pacific railroad from California eastward, bound from Japan to France. They left Yokohama, Japan, December 2. In this shipment were seventy-eight packages, valued at $800 per package.

MR. BRADY, M.P., is to be made an honorary fellow of the Irish College of Surgeons.

AS a proof of the extraordinary meteorological conditions which have lately prevailed, we may state that very large quantities of dead pilchards have been found floating about fifteen miles from the Cornish coast. Severe cold and scarcity of food are the causes assigned for this extraordinary appearance.

DR. LETHEBY has pointed out that the tea sold in certain quarters of London as "Fine Moning Congou," is nothing more than redried, exhausted, half-rotten tea-leaves. This discovery is a proof of the value of Sanitary Science, and of the necessity for the establishment generally of sanitary inspectors of a different type from those we now have, who are little better than *stench*-detectors.

WE congratulate Sir John Lubbock on his election to the borough of Maidstone. We believe that now the difficulty raised by his opponents has completely subsided. It is unnecessary for us to point out how much Sir John has done to advance Science. His treatise on *Prehistoric Man* and his edition of Sven Nilsson's *Stone Age* are well known to the public; but his reputation as a *savant* rests not on these, but on his numerous able memoirs in the *Transactions* of our Scientific Societies—the Linnean, Royal, and so forth. The member for Maidstone is, we believe, now in his thirty-sixth year.

THE following important scientific works are announced by Messrs. Longmans as in the press:—*Researches on Diamagnetism and Magne-Crystallic Action.* By John Tyndall, LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution of Great Britain. *A General System of Descriptive and Analytical Botany.* In two parts. Part I. Organography, Anatomy, and Physiology of Plants. Part II. Iconography, or the Description and History of Genera and Species. Translated from the French of E. le Maout, M.D., and J. Decaisne, Member of the Institute, by Mrs. Hooker. Edited and arranged according to the botanical system adopted in the universities and schools of Great Britain, by Joseph Dalton Hooker, M.D., Director of the Royal Botanic Gardens, Kew. With 5,500 woodcuts from designs by L. Stenheil and A. Riocreux. *Principles of Mechanism.* Designed for the use of students in the universities, and for engineering students generally. By Robert Willis, M.A., F.R.S., &c., Jacksonian Professor of Natural and Experimental Philosophy in the University of Cambridge. A new and enlarged edition. 8vo., with many woodcuts. *Other Worlds than Ours. The Plurality of Worlds Studied under the Light of Recent Scientific Researches.* By Richard A. Proctor, B.A., F.R.A.S., Author of *Saturn and its System*, &c. Crown 8vo., with illustrations.

THE trial of the guns and targets at Shoeburyness on Wednesday last resulted in a triumph for Mr. Brown's excellent armour-plated shield. The general impression of the scientific visitors was that the new shield showed great excellence and extraordinary endurance for its moderate price of about £1,300. Every plate and every bolt now made at Sheffield is so carefully tested that similar results may always be counted upon. The only defect was in the squeezing out of the port frames, and afterwards of some of the concrete. This may be obviated without difficulty, and it is almost impossible that any British shield will ever receive such a pounding as was given to the experimental one on Wednesday.

THE Council of the Society of Arts will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and was awarded in 1864 to Sir Rowland Hill, K.C.B.; in 1865, to his Imperial Majesty the Emperor of the French; in 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce;" in 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in recognition of their joint labours in establishing the first electric telegraph; in 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards;" in 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce." The Council invite members of the Society to forward to the secretary, on or before the 25th of April, the names of such men of high distinction as they may think worthy of this honour.

MR. BINGHAM, the English photographer, is dead. This will not convey anything extraordinary to the general reader, but the photographer will learn it with regret. Mr. Bingham died in Brussels a few days since, aged sixty years. He was one of the earliest photographers, and, unquestionably, one of the first experimentalists with collodion. He was a chemical assistant to Faraday when Schönbein first introduced his discovery of gun-cotton to this country, and, being an amateur photographer, he shortly after commenced experiments with collodion. He was the first to introduce Mr. Woodbury's photo-relief process into Paris, eventually selling it to Messrs. Goupil, and retaining a right to use it himself.

As a proof of the lamentable ignorance of the commonest scientific facts, the *Lancet* publishes the following amusing remarks on Mr. Craven's new play of "Philomel," at the Globe Theatre:—"A certain 'Dr. Adderly'—whom we are glad to see described as 'an irregular practitioner'—is busy poisoning a young widow medicinally, when his son, 'Ernest Adderly, M.D." suddenly returns to Jersey, where the scene is laid, and intervenes between the poisoner and his victim. He takes up a 'composing draught' which his father has left for the unfortunate patient, smells it, tastes it, and then gives utterance to the following exclamation—'Morphia! Digitalis!! Hydrocyanic Acid'!! skilfully disguised in almond scent!' The absurdity of the mixture and of the diagnosis we need not enlarge upon. We can only regret that the author did not submit this and other passages to a medical friend, when we should have been spared the announcement from 'Dr. Adderly' that oxide of arsenic is useful in aneurism, and that poison (unknown) when mixed with wine 'forms a perfect *amalgam*.' We quite appreciate the jest of making 'Mr. Judah Lazarus,' when injured in the arm, complain of being hit 'just above the *bugle*,' though we hope that the irregular practitioner's reproach to his son—'This is what you learn in London, to engross your father's patient'—is somewhat beyond the truth."

We are glad to see that the Highland and Agricultural Society is active in its exertions to promote a study of Scientific Agriculture. The syllabus of its course of lectures and subjects of examination, which was issued at the meeting on the 2nd inst., shows that it is in advance of other agricultural societies. On this occasion the minute of the joint meeting of the agricultural education examiners and of the Forestry Committee held on the 9th of February, was read, from which it appeared that it had been resolved to hold the examinations for the society's agricultural certificate and diploma this year on Wednesday and Thursday, the 30th and 31st March, candidates being required to lodge intimation on or before the 23rd.

The development of the Brachiopoda is the subject of a memoir on which Mr. E. Morse is now engaged. Zoological readers know how well this worker is qualified for his task.

Professor Oliver will begin his series of lectures on Botany, part of the series for the instruction of women in science and art, on Friday, the 11th inst., at 11 a.m. Professor Oliver's lectures, which will be delivered in the Lecture Theatre at the South Kensington Museum, will consist of ten discourses.

Dynamite seems to increase in favour with miners. The *Mining Journal* is informed that the quantity of this substance shipped by the St. John del Rey Company in June last, as announced at the meeting of the company by the chairman, has been safely received at the mines, and on trial has been found very effective. We are informed that the voyage and inland journey occupied four months, and that during that period this parcel of half a ton of dynamite was subjected to as severe a test, as regards rough carriage and handling, as it is possible to imagine. It was carried part of the distance from the port of Rio de Janeiro to the mines (300 miles) by the Government railway, a further distance in mule waggons, and finally over the mountains on mules' backs. This appears to settle the question as to its having any of the dangerous qualities of nitro-glycerine, which its opponents last year seemed desirous of fixing on it.

The Cuban Echinoderm Asterostoma is the subject of a paper by M. Cotteau.

A new part of Messrs. Christy and Lartet's splendid treatise, *Reliquæ Aquitanicæ*, has just been issued by Messrs. Taylor & Francis.

Dr. Beale's views on the development of the animal tissues have received some confirmation in an American treatise by Professor Tyson.

The new number of the *Journal of Botany* is an improvement on the old. The subscription has been greatly reduced. The new editors are likely, we should think, to satisfy the botanical world by their discrimination and energy.

The new building going on in the Horticultural Gardens is intended for the purpose of holding annual exhibitions of art and industry of the nature of the Great Exhibitions of 1851 and 1862, but so modified as to run over a series of years, instead of being crowded into one.

At the last annual meeting of the American Microscopical Society the following officers were elected:—President, Dr. J. H. Hinton; 1st vice-president, Mr. Robert Dinwiddie; 2nd vice-president, Mr. T. F. Harrison; cor. secretary, Dr. S. G. Perry; recording secretary, Dr. J. S. Latimer; treasurer, Mr. E. C. Bogert; librarian, Dr. John Frey; curator, Mr. S. Jackson. Committee on nominations:—Dr. D. H. Goodwillie; Mr. R. A. Witthaus, Mr. J. W. S. Arnold.

A specimen of the opah, or king fish, was washed ashore near Budle Bay on Monday last, and is now, says the *Farmer*, in possession of Mr. John Dixon, Belford. It is a fish seldom seen in northern waters, being a native of China and Japan. When first found it was in a perfect state, but some boys, not knowing its value, greatly disfigured it. It is a beautiful gold and silver colour, with large spots. It is 22 in. across the back, and about 36 in. long, and about 4 stone weight.

The *Giornale di Napoli* says that the subterranean canal destined to carry the waters of the Lake of Agano into the sea is now completed, being 1,400 mètres in length. This work, one of the most useful of those undertaken in these years by private persons, has been accomplished in spite of enormous material difficulties and considerable opposition.

The *Société Impériale Zoologique d'Acclimatation*, of Paris, has elected Dr. Hooker, director of the Botanic Gardens, at Kew, an honorary member, in consideration of his services rendered in the acclimatization of vegetables, and especially of the chinchona plant. Our excellent contemporary *Applied Science* states that medals of the first class will also be awarded at its meeting on the 4th inst. to the following:—Mr. P. L. Simmonds, of London, for his memoir on sericiculture in India; Mr. John J. Stone, China, for the importation of the pheasant of Amherst (*Thaumalea Amherstiæ*); Mr. G. W. Hart, of Hayling Island, for his labours in Ostreiculture; Mr. Edward J. Cooper, Ballysadare, for his salmon ladders; Sir Robert Officer, of Tasmania, for his labours in salmon introduction; Mr. Robert Thompson, Jamaica, for his cultivation of the chinchona in that island. Dr. J. L. Soubeiran, secretary of the society at Paris, so well known for his distinguished labours, on pharmacy, pisciculture, &c., has been elected an honorary and corresponding member of the Society of Arts, London.

The Council of the Royal Horticultural Society have awarded a silver medal to Miss Eleanor A. Ormerod, Sedbury Park, Chepstow, in recognition of the assistance she has given the Society's collection of economic entomology.

The Council of the Entomological Society offer two prizes of the value of five guineas each, for essays of sufficient merit, drawn up from personal observation, on the anatomy or economy of any insect or insects. The essays to be sent in before the end of November next.

The following are the scientific examinerships vacant in the University of London:—The annual election in the various departments is fixed for the 27th of April. Many of the Examiners offer themselves for re-election, but vacancies occur in the following branches:—Mathematics and natural philosophy, £290 a year; chemistry, £175 a year; chemistry (two assistants), £25 a year each; botany and vegetable physiology, £75 a year; two in geology and palæontology, £75 a year each; medicine, £150 a year; physiology, comparative anatomy,

and zoology, £150 a year; two in midwifery, £75 a year each; materia medica and pharmaceutical chemistry, £75 a year.

This is the age of deputations. The other day a number of gentlemen waited on Earl de Grey to urge on him the propriety of having political economy more generally taught in schools. The deputation thought thus to prevent strikes; but they forgot that some strikes show a knowledge of political economy of a very high order.

The Metric system is just making its way into Turkey. We may, therefore, soon hope to have it in England!

Professor G. Sigerson has been recently carrying out some experiments on sunbeams which tend to corroborate Dr. Tyndall's views on "dust." We shall hope to give an account of them in an early number.

The stone coffin of King Cissa (King of Wessex) has just been discovered at Abingdon.

On Saturday evening last Sir Ed. Sabine gave his first sessional soirée to the Fellows of the Royal Society at Burlington House. The gathering was a most brilliant one, and though many of the objects exhibited were of the usual stock-conversazione type, many novelties were exhibited.

The Edinburgh University is determined to put down the effort made by some of its professors to introduce female students into the ordinary classes and to enrol them as regular undergraduates. A meeting of the University Court was held on Thursday last, the Lord Justice-Clerk, rector, presiding. Among other business, the Court took into consideration a resolution of the Senatus Academicus, approving a proposal by Professor Balfour that he should give lectures on botany to women studying medicine in the university, and that he should not be required to give them a separate course, but should be permitted to enrol them as students in the ordinary class, as advertised in the *Calendar*; and also an appeal by Professor Muirhead against the resolution. The Court, in respect that the resolution of the Senatus appealed against was inconsistent with the regulations recently passed for conducting the education of women in medicine in the university, sustained the appeal, and recalled the resolution in so far as it authorized Professor Balfour to enrol women studying medicine in the university in his ordinary class.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

THE TERRACES OF NORWAY.

BY PROFESSOR KJERULF, OF CHRISTIANIA.

In Three Parts.—Part III.

The terraces are not our only evidence of the cessations of an upheaval generally considered by foreigners as continual. Several years since (1860) I had occasion to call attention to two other kinds of steps which testify to the same. The argument of these facts, entirely different and from independent series of observations, concerning the question of an intermittent upheaval, is so remarkable, that I will here shortly describe these steps.

The marine remains found in our country belonged to very different localities, and many investigators, more especially Lovén, were struck by the circumstance that many of those mollusca belonged to species inhabiting northern seas and a far colder climate than the present; but, at the same time, other shells were known not different in shape or size from those to be found on the adjacent shores.

The rules of this apparently irregular occurrence, now at a high, now at a low elevation, and of different marine remains, became obvious to me when I had learned to recognize the principal constituents of the covering drift. For here all is order and regularity.

These marine remains were found in two ways, one may say—partly heaped up in large quantities, so as to form shell-banks—so-called shell-marl—partly scattered here and there, in greater or less numbers, in the strata of clay or sand. Moreover, it had been stated by earlier investigators (Keilhau and C. Boeck), and also most completely proved by the later and further investigations of Professor Sars, that in the first localities where these remains were found the shell-marl is a coast formation.

It will be evident that here everything depended on elevation above the sea, and that each mode of occurrence was in its own special manner dependent upon the height. Let fig. 4 represent a portion of the rocky ground of Norway, in that colder state indicated by some of these marine remains; H H is the surface of the sea, 600 ft. above the present level. It is plain, such was my conclusion, that marine remains during this water-level of the water must partly be deposited at

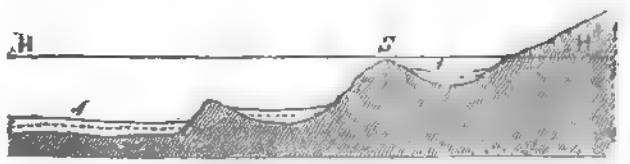


Fig. 4.

convenient spots (as S) in shell banks near the coast, and therefore at a *particular* depth under the surface of the sea, and partly must become buried here and there in clay, and sand deposited at the same time, and therefore *entirely* at *different* depths in strata (1 1), yet always below H H.

Now, let us suppose the sea-level to sink during a milder period to *h h* (fig. 5). All the glacial shell-banks, a part of the strata of clay and sand from the first state of things are laid

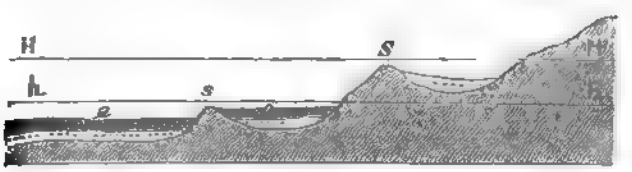


Fig. 5.

dry. Marine remains must be, during this period also, deposited partly at a certain height proportionate to the new water-level, namely as shell-banks (at *s*, fig. 5), partly buried with clay and sand in strata (2 2), deposited on the top of the former strata, yet always below *h h*.

This explains what at first sight might be considered the irregular occurrence of various remains at different altitudes.

In 1860,[1] assisted by the simple observations explained here, I attempted to establish the geological principles of the separation of the glacial from the post-glacial formation, with their respective connecting links, which I enumerated and described. In 1860 I was only able to mention nine of the older and more elevated shell-banks, and six more recent and lower. More can now be enumerated, and I have, besides, revised the heights, having referred to the original surveys, which, in many cases, give the height of the banks in question relatively to stations the altitudes of which have been exactly determined. As these banks are of the coast formation (Professor Sars observes that they belong to the seaweed zone), they indicate a definite level. As the seaweed zone is 90 ft. in thickness, we are justified in believing that sundry of these shell-banks belong to an identical period, though there may exist some variations in their height.

[1] The *University Programme*, before cited, for 1860, pp. 19—24, where also profiles are given.

I. *Localities of more ancient Shell-banks with Glacial Remains.*

	Feet above present sea-level.
1. Sververud, in Eidsberg	540
2. *Auke, in Röken	520
3. Skjældalen, in Aremark	476
4. Syltinglid, in Röker	475
5. *N. from Nordby Church, near Skydsjordet	475
6. Bjorum, in Asker	460
7. Hellesaaen, in Aremark	454
8. Stimyr, between Grorud and Strömmen	450
9. Damholt, in Rakkestad	440
10. Skullerud, in Höland	437
11. Killebo, in Rakkestad: *a*	440
b	475
12. Kolbjornsvic, in Aremark: *a*	400
b	410
c	455
13. Moen, near Asper Sound	400 ?
14. Björndalen, in Aremark	385
15. Kile, in Aremark	375
16. Samböl Skjældalen, in Aremark	350

1. Taken from road-level, Lundeby bridge. 2. According to road-level. 3. Surface 137′ above Kile lake. 4. According to road-level. 5. Supposed about the height of Skydsjordet. 6. According to road-level. 7. Surface 10′ higher than rock containing Balanus, which measured (Keilhau and Boeck) 114′ above Kile lake. 8. Taken from level of railway. 9. Supposed to be on same level as Killebo. 10. Conjectured 60′ to 70′ above Skullerud lake. 11. Surface 102′ above Odemark lake; (*b*) a small bank 30′ to 40′ higher. 12. (*a*) Bank close to sea; (*b*) a rather higher bank; (*c*) one still higher. 13. Conjectured from road-levels not far off. 14. Conjectured 30′ to 70′ above Kile lake. 15. Slightly higher than Kile lake. 16. Slightly above Kile lake. The lake levels are taken from the map of the canals.

Those places marked * are not described by Professor Sars in the *University Programme* (Christiania, 1865), "On the Fossil Remains of the Quaternary Period," in which essay he treats exhaustively of the fossils. Where the honoured author strays into the field of geology I cannot always agree with him.

I must here also take the opportunity of rebutting the complaints which Professor Sars, in this work of his in 1865, makes concerning my remarks on concretions of marl, written in 1860. In 1863 I revoked my earlier and incorrect opinion, and, instead of that, gave an explanation approaching very nearly (see *Transactions of the Scientific Society of Christiania*, 1863, pp. 101-107) to Professor Sars' later opinion. More could not have been demanded. But I certainly did expect that the Secretary to the Scientific Society would, even two years later, remember the somewhat long-winded discussions on this subject.

II. *Localities of more recent Shell-banks containing Post-Glacial Remains.*

	Feet above present sea-level.
1. *Between Kvalnes and Reppen, Varanger Fjord	150 ?
2. *Korsen, Borgen Fjord, North Trondhjem Amt	148
3. *Dal at Næsodlandet, near Christiania	148
4. Hövig, in Asker	125
5. Aafos, near Skien	125
6. Löveidet, near Skien	120
7. *Kordalen, near Tokevand, hard by Kragerö	115
8. Ommedals Strand, near Skien	100
9. At Rüsöer	80
10. Sparebakken, at Skien	75
11. Fornæs in Stod, North Trondhjem Amt	70
12. Snaasen lake, North Trondhjem Amt	65
13. *Gyrihangen, at Soverlven, between Hitterdal and Nordsjö	55
14. Örnerede, Hvalöerne	50 ?

1. Conjectured height, on the authority of Herr Mortensen, who has sent specimens from this locality. 3. Average of two surveys, one giving 164′ (?). 4. 100′, 150′. 5. 120′, 130′. 6. Surface 20′, 30′ above an ascertained level. 7. Conjectured from the height of the Tokevand. 10. Professor Sars gives in the *New Magazine of Natural Science* 25′ (?). 11. 60′, 80′ 12. 60′, 70′. 13. From the statement of Herr Heiberg, Civil Engineer, who sent specimens. 14. Conjectured by Professor Sars. Those marked * are not described by Professor Sars.

To make the relation clear between the older and more recent and differently situated links as laid down in fig. 4 several altitudes are added, up to which I have found marine deposits in the strata of clay and sand of different plains and valleys.

III. *Highest altitudes up to which Fossils have been found in older Strata of different localities.*

	Feet above present sea-level.
*Drammen, at the granite boundary on the Konerud Road (*Saxicava rugosa*)	460
*Heimdal, close to Trondhjem Railway (*Yoldia Pygmæa*)	430
*At the Nordset, Nidelven, South Trondhjem Amt (*Yoldia Arctica.—Saxicava*)	300
*Ler Annet in Börsen, South Trondhjem Amt (*Leda pernula*)	265

IV. *Greatest altitudes up to which Fossils have been found in the more recent strata (clay and sand) in different localities.—N.B. Both fossils ancient and recent may be considered as found from these heights down to present sea-level.*

Grorud, Christiania Railway	380
Near Asker Church	360
Strommen, Christiania Railway	350
*Near the blue-dye works, Fossum	310
*Burud, Ringerige	300 (?)
Hasler, near Christiania	270
Windern, near Christiania	?
*Vikersund, Drammens Railway	250
Lekum, in Edsburg	220
Berg, near Kragerö	120

From these tables it will appear that the coast-level marks the glacial epoch of one or more high-level steps at between 520′ and 350′ above the present sea-level. Furthermore, that during the post-glacial period the coast showed one or more steps at the lower level, between 150′ and 50′ above present sea-level. Still further, that fossils were deposited during the first period in strata from a maximum altitude of 460′ downwards, while during the latter period the maximum limit was nearly 100′ lower, and thence downwards. It is also plain from the figures in the first two tables that the change of level had already begun during the glacial, and been continued during the post-glacial period. So far one is justified in attempting an estimate of time at this stage, but that the rising was not uniform may be concluded from the circumstance that the first two tables do not give an unbroken series of altitudes from the greatest down to the sea-level, but we may collect from the figures sundry average levels, as 530′, 400′, and 150′, 120′, 50′.

If we now—after having convinced ourselves that the shell-banks tell us of several steps referrible to the old sea-level—again turn to our valley terraces, we shall with greater facility trace steps. Further on I shall enumerate some steps observed in the Norwegian valleys. *They are not all marine*; if, calling them "stratified drifts," as consisting of strata of sand, clay, and gravel, we consider them all as affording satisfactory marks of an ancient sea-level, we shall act in contradiction to every geological practice.

I hope that I may be able to continue these investigations, and I have, since the conclusion of our meeting of naturalists, completed the list from observations taken during the summer of 1868. The heights given are partly found by surveys with an aneroid barometer, partly calculated from sights with Wrede's levelling mirror, and from the best local maps of the Survey department; they are also partly taken from the corresponding road-levellings or proposed railway lines, on the authority of the Department in question.

[The author here describes 30 different valleys of the south, west, and north of Norway, pointing out in each of

them the gradual steps or terraces, their situation, and level above the sea.[2] He sums up the results as follows.—TRANSLATOR.]

When the necessary measurements shall have been procured from the several valleys throughout the country, it will perhaps be possible to draw some conclusions as to the former rising.

In the mean time it appears to me from the survey already made:—

1. That open terraces, formed by the joint labour of river and sea, are, as a rule, to be found in our valleys,[3] and that the steps afford evidences of cessations in the rising of the land.

2. That the change of level, or the rising, began during the glacial period with the highest discovered ancient level, which, both north and south of the mountains in Norway, can be put at somewhat over 600 ft. above the present sea-level.[4]

3. That the comparatively glacial state of things which prevailed with the 600-ft. level existed contemporaneously with that level which is now indicated at heights varying from 530′ to 400′. During this period the glacial coast shell-banks were deposited (List I.), and all the older strata in which we find shells at the maximum height of boundaries of every locality hitherto discovered. (List III.)

4. That this period was succeeded under the above-mentioned levels by a comparatively mild climatic condition, during which the mollusk-bearing clays especially began to be deposited at the altitudes indicated in List IV. If coast shell-banks of a mixed nature really should be discovered they would belong to this level.

5. That the melting down of inland ice must have begun with the highest found level—600′, as we find large masses transported by floods down the valleys, and deposited in the most bulky terraces of all we are acquainted with, just at this highest level. Further, that also at several following times, under the milder climate, a large transportation took place down the same valleys, where, perhaps, in a comparatively short time, materials were stored up in steps corresponding to the existing sea-level. Further still, that changes of sea-level during a given period might perhaps take place in rapid succession, for instance, thos eindicated by many of the steps of the lower terraces, without corresponding coast shell-banks having opportunity to form during the lapse of this period.

6. That there are found in many watercourses unmistakable traces of basins, which once have been more completely filled, and the several floods mentioned (5) very probably were produced by disruptions of the dams of the basins at different times.

7. That rest or slow change began at the level of 150′–120′, or perhaps at that of 50′, since we here again find shell-banks at heights corresponding.

8. That the observations here collected, added to those which we owe to investigators who have previously bestowed special attention and independent observation upon the phenomenon of the terraces (Keilhau and Bravais), contain a protest against the unlimited computation of time which has been based upon a continuous rise, which "continuous rise" cannot be proved to have taken place in a succession of time without a break. —*Translated from the Norsk.*

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[2] Amid the terraces on open flats the author points out some having much resemblance to the Åsar of Sweden. Such Åsar-like ridges of stratified sand, gravel, and clay, are not the work of the sea, but the remains left by denudations of the terraces, which are themselves the compound work of the watercourses and the sea.

[3] They have been pointed out above in more than thirty different valleys throughout the country.

In the western part of Norway nothing at present can be said concerning this with certainty.

ON RECENT IMPROVEMENTS IN MICROSCOPE OBJECT-GLASSES.

BY THE REV. J. B. READE, M.A., F.R.S.

WITH respect to the attempts brought before us to improve the microscope itself as an instrument of scientific research, I must refer to Dr. Royston-Pigott's paper "On High Power Definition," and to my own paper "On the Equilateral Prism." Considering a perfect microscope as consisting of two parts, a magnifying apparatus and an illuminating apparatus, Dr. Pigott proposes to weed out, as it were, an effective portion of the small residuary spherical aberration of the best objectives, and I have ventured to propose a principle of illumination which has not hitherto been avowedly advocated. When Dr. Wollaston recommended for an illuminating lens one of three-fourths of an inch in focal length, in which the microscopic object was placed in a vortex of foci, where the rays crossed in a thousand points both before and after they fell upon the object, he failed to realize the true method of illumination. Spherical and chromatic aberration are equally injurious in either of the essential parts of a microscope. The equilateral prism, used as a condenser, and the hemispherical lens, used as a prism, are free from both these errors. They supply, the one a condensed, the other a simple, single beam of parallel light; and a microscopic object, under such illumination, has virtually the advantage of being illuminated as by the sun. Natural light and shade are secured, and objects, like the valves of the Diatomaceæ, which hitherto have been shrouded in a haze of interpretations, are truthfully presented to the observer. I therefore look upon the prism as a kind of "Zaphnath-paaneah"—a revealer of secrets.

Dr. Pigott's work is more arduous, and it certainly met in the first instance with an encouraging amount of opposition—encouraging, I mean, to one who knew—and was prepared to defend—the right. For my own part, I must honestly say, and I am not alone in my opinion, that I did not believe a word of it. In point of fact, I was sure that Dr. Pigott's "beaded scale" was not the true *test scale*. True, we were all taken by surprise and uttered our criticisms freely; yet, in my own defence, I must be allowed to say that I do not concur in the personal comments reported in our *Proceedings*, and now willingly cancelled. I felt, however, that I had sat too long at the feet of my old friend, Andrew Ross, to admit the possibility of his good work being vitiated by this newly-announced error, and what I did not look for I did not find—but only because I did not look for it, not because it did not exist. There is undoubtedly in our best objectives a residuary spherical aberration—small, I admit—but it is unnecessary to say to a microscopist that its injurious effect upon the magnified image of an object varies directly as the square of the power of the eye-piece. It would be beyond the scope of a President's address to point out how this small but injurious amount of error may be detected and diminished. This must remain as a fundamental problem in the optician's Euclid. It is enough to record *the fact of improvement* as one of the salient points of the year. I will therefore only add that those who, like myself, have seen Dr. Pigott's exhibition of the beaded scales of *Lepidocyrtus curvicollis* and *Degeeria domestica*, can only sincerely thank him for taking the trouble to compel us to believe that a successful raid upon the existing trace of spherical aberration is not a myth.

The immersion lens, the "hydro-objective," has probably an advantage in "the battle of the glasses" over the "pneumo-objective," as pointed out by Dr. Pigott; and Mr. Ross has laid us under further obligation by kindly adding immersion-fronts to his $\frac{1}{8}$th and $\frac{1}{15}$th in our possession. The high praise, however, which is given to the immersion system will perhaps be received with caution until more extended observations have been made upon its powers. Yet all seem, at

present, to admit that considerable advantages are gained by its use. The light is more abundant, the colouring of natural objects more brilliant, the definition keener: inferior glasses are frequently improved by its application: illumination can be more effectively employed with a less complex machinery of stops, diaphragms, and condensers; above all, facility of construction seems to be indicated by the offer of the highest powers at the lowest prices. This intimation comes from the Continent—*A $\frac{1}{15}$th for fifty shillings!* Is such work possible at home? Still we have yet to learn, notwithstanding these acknowledged advantages, whether there are any considerable drawbacks looming in the microscopic future which may in some measure counterbalance the employment of water refractions. Of one thing we may be sure, that absolute perfection is unattainable. The ghost of aberration will never be entirely exorcised even by cold water. It is there—do our best—and after all our compensations for figure, as for colour, there ever must be a little ghost of an error in all probability. At the same time, I believe it to be reduced to the *minimum visible* when the *colour test*, so strongly advocated by Dr. Pigott, is fairly exhibited on the stage. Thus the natural colours, for instance, of the upper and lower rows of beads on the scale of *Degeeria plumbea* seem, for the first time, to be brought out by Dr. Pigott's more accurate balance of positive and negative aberrations. But this part of the subject is extensive, and must be left for further research and observations.

It is proper to remark that Colonel Woodward has resolved the 19th band of Nobert's lines with a Powell and Lealand's $\frac{1}{16}$th immersion. He is the only observer who has succeeded in resolving 112688 lines to the inch, with a power of 1000 linear. But these lines present the same appearance as lines drawn about 112 to the inch would afford at a distance of 10 inches, to the ordinary sight,—which are evidently exceedingly close for numeration. No other powers in Colonel Woodward's possession could resolve this 19th band, and this is a strong fact in favour of the immersion system. But even here diffraction lines are multiplied, and the divisibility of the lines is a function of the breadth of the groove ploughed in the glass—the depth to which it is cut—the sectional shape of the groove itself—and the direction and character of the illumination employed. All these variable conditions in some measure detract from the fixed value of this test. It ought to depend upon the uniformity of standard conditions. The *Acus*, as shown by Mr. Powell, is a sharper and safer test.—*Anniversary Address to the Royal Microscopical Society, in Monthly Microscopical Journal for March.*

AMBROSINE, A NEW ORGANIC MINERAL SUBSTANCE.

BY CHARLES U. SHEPARD, SEN., OF CHARLESTON, U.S.

AN irregular oval-shaped mass of a mineral, closely resembling amber, has been brought to my notice by Major Edward Willis, of this city, and is here noticed in the hope that an additional supply of the same curious substance may be obtained by our phosphatic explorers. The present mass was originally of the size of a man's fist. It is of a yellowish brown colour externally, but within is clove-brown. It breaks with about the same facility as amber; has a conchoidal fracture, and a resinous lustre. It is feebly translucent. Its specific gravity is but slightly above that of water. Indeed, small fragments of it when thrown into water float for a short time, until they part with adhering air, when they slowly descend through the liquid. It is strongly electric by friction. It melts into a clear, yellowish liquid at about 460° Fahr., though it softens at a much lower temperature.

It gives off considerable succinic acid long before it melts. On fusion a dense yellow oil is volatilized, attended with an agreeable balsamic odour, wholly unlike that from the resins of our pines. A dark brown, non-volatile fluid remains behind so long as the melting heat is kept up.

As it differs from any of the oxygenated hydrocarbons known, I have called it Ambrosine—a term compounded from the two words amber and resin; to both of which substances it bears a resemblance. It is very combustible, burning with a bright, yellowish white light, a pleasant odour, and without leaving any carbon, or even the slightest ash behind. It is largely soluble in oil of turpentine, alcohol, ether, and chloroform, as well as in a solution of potash, and is feebly taken up by the strong acids without suffering decomposition.

It probably originated in some of the coniferous trees that existed during the pleiocene epoch in geology, when our phosphatic formation was in progress of deposition.—*Rural Carolinian.*

BIOGRAPHICAL SKETCH OF MR. B. D. WALSH, THE ENTOMOLOGIST.

BENJAMIN DANN WALSH was born in Frome, Worcestershire, England, on the 21st of September, 1808, and was therefore in his sixty-second year. He graduated at Trinity College, Cambridge, and his parents intended that he should enter the ministry; but he was not theologically disposed, and naturally had such a strong hatred of hypocrisy and of everything that had the semblance of wrong, that—judging from what he has told us—the inconsistent conduct of some of the collegiates who were studying for the ministry, in all probability prejudiced him against the Church. At all events his tastes and inclinations were of an entirely different character from those which are necessary to make a minister of the gospel. We can learn but little, even from his wife, of his career in England, but we know that he there published a bulky pamphlet on university reforms, almost all the suggestions in which he lived to see practically carried out. He also wrote for *Blackwood* and other English periodicals, besides newspaper articles without end, and in 1837 published a large octavo volume in London, entitled *Walsh's Comedies of Aristophanes*. This volume is in many respects remarkable, embracing as it does the "Acharians," the "Knights," and the "Clouds," translated into corresponding English metres. There are many passages in this work illustrative of that same forcible style and utilitarian logic which so characterized his entomological writings.

This work was to have been completed in three volumes, but, owing to some difficulty with the publishers, we believe none but this one volume was ever issued.

Mr. Walsh married in England, and came to America in 1838. All his relatives are in England, and he has yet living five sisters and three brothers. Of the latter, Thomas Wm. Walsh, M.D., still resides at Worcester; J. H. Walsh ("Stonehenge") is the present editor of the London *Field*, and the well-known author of one of the best works on the horse in the English language; while the third brother, F. W. Walsh, is a clergyman and schoolmaster.

Upon arriving in this country he went into Henry county, in Illinois, and purchased a farm of three hundred acres, near Cambridge, the county seat, where he determined to retire in great part from the world, and lead the life of a philosopher. He soon became thoroughly devoted to this country, and never once returned to England or expressed any desire to do so. He remained on the farm for upwards of thirteen years, leading a very secluded life, and associating but little with his neighbours, from the fact that there were few, if any of them, who were his equal in intellect, or could appreciate his learning. Yet he was thoroughly Democratic in his ideas, and had no false pride whatever: he did, as far as possible, all his own work, even to making his own shoes and mending his own harness. Finally, a colony of Swedes settled in his neighbourhood, and, by damming up the water at Bishop Hill, produced so much miasma in the vicinity, that very much sickness pre-

vailed there. His own health in time became impaired, and at the suggestion of M. B. Osborn, of Rock Island, he removed to that city in 1851, and entered into the lumber business. He carried on this business about seven years, during which he found time to publish much fugitive matter in newspapers, principally on political topics, always affixing his signature, and scorning even the appearance of deceit.

In politics he was a Radical Republican, hating all forms of slavery and oppression. As late as Grant's campaign he was a member of the Tanner's Club of Rock Island; and we shall never forget the enjoyable hours we spent with him at some of the meetings of the Club, where one forgot his real age in contemplating his unusual good spirits, activity, and vigour. In 1858 he suspected that the City Council was cheating the city, and though no politician, he ran for alderman for the express purpose of getting at the books, and of thus being enabled to investigate the matter and publish the facts. Such a course naturally made him many enemies, and he was waylaid and his life threatened; but he succeeded in getting elected, and after exposing the frauds, and thus accomplishing his purpose, he resigned. In the same year he retired from the lumber business with something of a competency, and built a row of buildings on Orleans and Exchange-streets, known as "Walsh's-row."

Up to this time, though he had formerly made a small collection of insects in England, he had paid no attention to entomology in this country. But as soon as the buildings were erected, he devoted himself entirely to this, his favourite science. Thus his entomological career dates back scarcely a dozen years, but how faithfully and perseveringly he laboured, the record of those years abundantly testifies. The first published account that we can find of Mr. Walsh as an entomologist is in the report of a lecture which he delivered before the Illinois State Horticultural Society at the Bloomington Convention, in January, 1860. He there spoke extempore for two hours, displaying that rare faculty which he possessed of communicating his ideas in such a manner as to please and hold the popular ear. The reporter of this lecture, whom we take to be Mr. C. D. Bragdon, at the present time one of the editors of *Moore's Rural New Yorker*, states that he became so intensely interested, that his hand refused to move his pencil. After this time he became a regular contributor to the *Prairie Farmer*, of Chicago, Ills., and also wrote for a few other agricultural journals, such as the *Illinois Farmer* of Springfield, Ills., the *Valley Farmer* of St. Louis, Mo., &c., his aim throughout being to rouse the agriculturists to a sense of the immense losses they sustain from the depredations of injurious insects, and to impress upon them the necessity of a more general knowledge of the habits of these little foes. From 1862 to 1866 we find about a dozen scientific papers from his prolific pen, scattered through the *Proceedings of the Boston Society of Natural History*, and through those of the Philadelphia Entomological Society. These papers are all characterized by great freshness, originality, and accuracy, and they will for ever redound to his honour, and in our minds will be more and more appreciated as the true workings of Nature are better understood. Mr. Walsh was a school-mate with Darwin, and, though he took up the latter's work on the *Origin of Species* with great prejudices against the development hypothesis, yet he became a thorough convert to Darwinism after he had once studied it. Throughout these papers he consequently brings forward a great number of facts in support of this theory, and his remarks on Phytophagic Varieties and Phytophagic Species bear directly on this subject and have done much to help us to a clear understanding of the term "species."

In October, 1865, the Entomological Society of Philadelphia commenced the publication of a monthly bulletin entitled the *Practical Entomologist*. This little journal was edited by the publication committee of the society, consisting of E. T. Cresson, Aug. R. Grote, and J. W. McAllister. Very soon, however, Mr. Walsh was added to the list, as associate editor from the West, and he finally became sole editor of the second volume, the publication being discontinued in September, 1867. So well had he succeeded in opening the eyes of the people of his own State to the vast importance of economic entomology that the State Horticultural Society at last petitioned the Legislature to appoint a State entomologist, and accordingly at the biennial session of 1866-7 a Bill was passed authorizing the appointment of such an officer with a salary of $2,000 per annum, the appointment being vested in the Governor, by and with the consent of the Senate. At the special session held in June, 1867, the Governor sent in, on the 11th of that month, the name of Mr. Walsh for confirmation, but the Senate postponed all action upon it till the next regular biennial session in the winter of 1868-9. Mr. Walsh, however, at the earnest solicitation of many of the leading agriculturists and horticulturists of the State, went on and discharged the duties of the office, and trusted to the future liberality of the Legislature to reimburse him for his work. As Acting State Entomologist he issued his *First Annual Report for* 1867, which was published as an appendix to the *State Horticultural Transactions* for that year.

In September, 1868, in conjunction with the writer, he started the *American Entomologist*.—*American Entomologist*.

INSECT EMBRYOGENY.

THREE years ago the entomological world was much interested in the discovery of the phenomenon of parthenogenesis in the larva of a gnat (Cecidomyia). The particulars are given in Dr. Fripps's paper in the *Popular Science Review* for April, 1867. They are very curious. It has not hitherto been surmised that the larva of *Aphrophora spumaria*, the Cuckoo-spit, affords another instance. The Baron De Geer, the great Swedish naturalist, noticed that the female Frog-hoppers (so the perfect insects are called) become so gravid in September that they can scarcely fly. The eggs could not well cause this inconvenient gravity, because they are deposited at a much later season—in England certainly, and probably in Sweden also. The eggs do not seem to encumber the insect, according to my observation, even in December, immediately before their deposition. We may, therefore, suppose De Geer's observation to have applied to females about to become viviparous; though he does not seem to have suspected it. That it might have been so, is rendered certain by the occurrence of an embryo within the abdomen of a larva taken in my garden, and now in my cabinet. The claws, eyes, proboscis, and antennæ are to be clearly distinguished, and even the lenses of the eyes when considerably magnified. The antennæ appear of an unusual size; but they comprise only the normal parts, and are obviously immature. The mother larva in this example is about three parts grown to maturity; the wing-cases being still incomplete beneath the outer skin.

This discovery—for such it is presumed to be—may, it is hoped, in some degree condone for any mistakes in my first paper on this insect, *Science-Gossip*, 1868, p. 168. Doubtless the larva does change its skin repeatedly, like other larvæ, though I have argued on the contrary supposition. The changes, however, may take place at such long intervals that my inference may not be wholly damaged. It may now be left to entomologists and physiologists to pursue this new fact, unexpectedly started upon a well-beaten field.—*Science-Gossip*.

Spontaneous Combustion.—*L'Union Médicale* of February 15 contains an article from the pen of Dr. Bertholle, wherein full details are given of a case of spontaneous combustion. The subject of it was a woman, thirty-seven years old, who was addicted to alcoholic drinks. She was found in her room with the viscera and some of the limbs consumed, the hair and clothes having escaped. The very minute description of the state in which the deceased was found shows that ignition could not have been communicated from without, and, to all appearance, this is an additional case to those already upon record.—*Lancet*.

THE CAVE OF BRUNIQUEL.

THE CAVE OF BRUNIQUEL.

We have certain proof that primitive races during this period lived exclusively in natural caverns, though they knew how to form more convenient abodes under large rocks. There have been discovered in various parts of France, and particularly in Périgord, numerous unroofed human habitations. These are simple abodes, situated under great escarpments and protected from the inclemency of the weather by more or less considerable projections of rocks, forming a sort of roof. They have given to these abodes of primitive man the name of *abris sous roches*. It is generally at the bottom of valleys, in the proximity of watercourses, that these rustic retreats are to be met. They contain, like the caverns, deposits very rich in bones of mammals, birds, and fishes, and also axes and utensils of flint, bone, and horn. Traces of fires are also to be found there. The most remarkable of these abodes peculiar to the reindeer period has been discovered at Bruniquel, in the department of Tarn-et-Garonne, not far from Montauban. On the left bank of the Aveyron, under the shelter of the slope of one of the highest rocks of Bruniquel, in the proximity of a castle whose picturesque ruins are still situated on those steep crests, a fire of prehistoric times was discovered in 1866, which gives the most complete

idea of the *abris sous roches* of the people of the reindeer period. This rock, known under the name of "Montastruc" has a height of 30 mètres, and its slope attains a length of from 14 to 15 mètres. It covers a space of 250 square mètres. It was there that M. V. Brun, Director of the Museum of Natural History of Montauban, collected a number of objects, the study of which has thrown so much light on the period of primitive man. The photographic sketches which M. V. Brun has sent us have enabled us to prepare the illustration on p. 246.—*L'Homme Primitif*, par M. Louis Figuier.

REVIEWS OF BOOKS.

The Cell-doctrine: its History and Present State. For the Use of Students in Medicine and Dentistry. Also a copious Bibliography of the Subject. By JAMES TYSON, M.D., Lecturer on Microscopy in the University of Pennsylvania. Philadelphia: Lindsay & Blakiston. 1870.

IT is a curious fact in the history of biological doctrine that, great as has been the advance made in the optical perfection of the microscope—an advance which has reached even theoretical possibilities—our knowledge of the processes by which the structureless becomes the structure is as unsatisfactory as it was before the time when Caspar Friedrich Wolf, in 1759, wrote his splendid *Theoria generationis*. Much as has been done—and nearly all the great histologists of the last hundred years have approached the subject—to enlighten us as to the mode of formation of the animal and vegetable tissues, we cannot deny that we are, even now, in almost Bœotian darkness as to the nature of the phenomenon called cell-formation. In the early phase of most animal tissues we find a mass of matter gelatinous in appearance, but absolutely devoid of structure, save for the presence of a number of extremely minute granules. Later on in the life of many of these tissues we find not a simple structureless substance, but a congeries of minute vesicular-looking bodies, separated from each other by an intervening translucent material, inclosed as it were in little envelopes of their own, and including within them one or more smaller and more solid-looking particles. To the arrangements of parts thus seen special names have been given. The vesicles are termed *cells*, their envelopes *cell walls*, their contained corpuscles *nuclei* or *nucleoli*, and the matter which at once separates them and binds them together the *intercellular substance*.

The tendency of the philosophic mind to speculate on causes and results has not been absent in the case of the histologist. Hence, we find that during the last hundred years hosts of theories have been put forward to account for the cells and nuclei already described, and we shall not be going too far if we assert that the most of these speculations have been purely gratuitous. Not only have few observers tried to watch the changes of development, but most of them have constructed the doctrine first, and have tried, as our Transatlantic friends would say, to "lick it into shape" afterwards. We are sorry to think that, important as is the history of the attempts made to explain cell-life, very few of our modern writers are acquainted even with its outlines. The task, therefore, which Professor Tyson set himself was one of great difficulty and of no less usefulness, and we may say at the outset that it has been very successfully discharged.

Dr. Tyson, in a volume turned out as American publishers know how, has given us a succinct and very accurate historical statement of the theories framed from time to time to account for and explain the process of cell-development. After a few preliminary remarks, in which he sketches out the attempts made before the memorable works of Schwann and Schleiden appeared, he then describes in succession, and in very clear language, the theories of the latter, and those of Henlé, Goodsir, Huxley, Bennett, Todd and Bowman, Virchow, Dujardin, Beale, Robin, and Pouchet. Having analyzed and critically examined all these, he then gives his own views, and finally concludes his volume with a most copious bibliography of the whole department.

We are very well pleased with the author's treatment of his subject. There is a fine honesty about the way in which he states the views even of those to whose theories he is opposed, and we note that in some cases he has been at great pains to do justice to certain observers. Indeed, it is with some little shame for our own writers of physiological works that we find Dr. Tyson the first to give a fair and tolerably full account of Professor Huxley's admirable essay in the *Medico-Chirurgical Review* for 1853—a paper which we believe to be the most candid and philosophical exposition of our exact knowledge of cell-growth which has ever been written. The illustrations to Dr. Tyson's work are not numerous, but they are to the point, and are not simply given for pictorial effect.

Of the view which the author holds he himself says that his theory is pretty much that of Dr. Beale. We think differently. It seems to us that Dr. Tyson's ideas approach those of Professor Huxley very much closer than they do those of Dr. Beale. Dr. Beale says—and we hope he will correct us if we misrepresent him—tissues consist of two parts, germinal or growing matter, which corresponds to the nucleus, and formed or *dead* matter, which is represented by the cell-wall and intercellular substance. Professor Huxley (1853) regards the tissues as made up of endoplasts (the nuclei) and periplast (the primordial utricle of Von Mohl, the cell-wall, and the intercellular substance). He denies that the nucleus is the organizing centre from which the so-called vital processes of growth originate. Admitting that the nucleus grows and sub-divides, he sees in it nothing more than this. It is the periplast which undergoes those changes of differentiation, chemical and morphological, which form the adult tissue. It will be thus seen that while both Huxley and Beale discard the old doctrine that the cell is a sort of organic entity, the former regards the intercellular substance and cell-wall as being full of life and susceptible of all those changes of form which characterize life, while the latter regards the same part as *dead* or formed, and incapable of *vital* processes.

Now Dr. Tyson, who thinks that he holds nearly in their entirety the views of Dr. Beale, really adopts a view which is fundamentally different, for while Dr. Beale, as we have said, denies the vitality of the cell-wall and formed matter, Dr. Tyson says, of this formed matter that:—

"It is exceedingly important, and as essential indeed to the functions of the economy as the germinal matter. It is, in fact, the portion of the cell in which alone function resides, since it is to the formed material of the muscle cell that we owe the property of contractility, to the formed material of the nervous element that we are indebted for neurility, and to the formed matter of the epithelial cell that we owe its protective qualities. . . . . Hence we would not, in every instance, speak of the formed material as dead where it is the seat of so many important vital endowments as in nerve and muscle."

The only point of agreement between Dr. Beale and Dr. Tyson consists, then, in the belief that the cell-wall and the intercellular substance both result from certain metamorphoses of the granular matter which constitutes the nucleus of the cell. In this both differ from Professor Huxley. For ourselves, we quite agree with Dr. Tyson in believing that the cell-wall or fibre, or intercellular substance, cannot be regarded as dead, or even vitally dead—for we believe that Dr. Beale makes a distinction between vital and chemico-physical death,—so long as it is the seat of those vibrations which are expressed to our senses in muscular and nervous phenomena; and we are glad to find that one of Dr. Beale's most able disciples disagrees with his master on this point. But we would ask Dr. Tyson what his conception is of the nature of the vital processes which go on in "formed matter,"

if he denies to this matter the power of "growth"? It appears to us that phenomena like those displayed by nerve are such as to imply a most extensive and rapid destruction of tissue; and if so, how is this loss repaired? Surely, neither Dr. Beale nor Dr. Tyson would have us believe that the proportion of so-called "germinal matter" in the adult tissues is adequate to such grave reconstruction of parts as is momentarily and hourly going on in the body? We still want some satisfactory explanation of these points; and till we receive it we prefer to cling to Wolf and Huxley's generalization, which is really nothing more than an expression of the facts so far as we are at present acquainted with them.

We commend our young and enterprising microscopists to the study of this problem, so fraught with importance to physiology, and we think that in commencing they cannot better prepare their minds for their researches than by carefully studying Dr. Tyson's most valuable treatise.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

Reply to Frankland and Duppa's Note on "The Successive Action of Sodium and Iodide of Ethyl on Acetic Ether." —*From* Professor J. Alfred Wanklyn, F.C.S.

Sir,—Dr. Frankland can hardly be said to have been very fortunate in the communication recently made to the Royal Society in his own name and that of Mr. Duppa.

The theory by which he tried to account for the non-production of hydrogen in my experiments—viz., that this gas was suppressed by high pressure—fails in its object, for the reason that I never worked at high pressure, and that in some of the most decisive cases I worked at no pressure whatsoever.

The account which Dr. Frankland gives of my experiments is not very accurate; there is one very curious mistake in it, and a number of curious omissions, and I should recommend the consultation of the original memoirs to such persons as may be desirous of knowing what has been really done.

In Dr. Frankland's account of his and his colleague's experimental proceedings, it is amusing to note how profuse he is in his declarations of the purity of his acetic ether, and how very certain it is that the ether contained a quantity of alcohol.

Referring to the memoir in the *Philosophical Transactions* for 1866, it will be found that the *only* proof of the purity of the acetic ether used in the great research was that its vapour-density was 2·9, which, instead of being the vapour-density of pure acetic ether, is the vapour-density of a mixture of 95 parts by weight of acetic ether, and 5 parts of alcohol. The method by which he describes himself as having now insured that his acetic ether shall be devoid of alcohol, is still more wonderful. It consists in prolonged digestion with, and distillation from, sodium-amalgam. The effect of such a course of treatment is to charge acetic ether with a certain proportion of alcohol. In an experiment of my own, published about a year ago, I found that repeated distillation of acetic ether, from strips of sodium, furnished an ether contaminated with 15 per cent. of alcohol. The effect of sodium-amalgam must be of a similar kind, only less in degree. I may here suggest that by the persevering employment of this exquisite method of purification, very important results might be arrived at, as for instance, that the purer the acetic ether, the greater the development of hydrogen, and the still more interesting one, that alcohol suppresses the development of the gas (being in this respect like high pressure). Doubtless Frankland and his eminent colleague have some such fact in store for me should I persist in making a fuss about the possible presence of alcohol in their ethers.

I agree with Dr. F. that his method of operating differs essentially from mine. As he says, he digested large quantities of acetic ether and sodium for several days, and at temperatures which rose to 130° C. By this modification of the method he insured the formation of a large quantity of alcohol as a secondary product, and was thereby enabled to report "torrents of hydrogen," and to remedy any defects that might have been produced by the accidental preparation of too pure a specimen of acetic ether in the first instance.

I remain, &c., J. Alfred Wanklyn.

Underground Temperature.

Sir,—I beg to send you the temperature at 2 ft. below the surface in my garden this year, and also last year when noted.

1870.		1869.	
Feb. 1 to 5	39°	Feb. 1 to 5	44°
6	40°	8	46°
7 to 9	41°		
10	40°		
11	39°		
12	38°		
13 to 15	37°	13	47°
16 „ 24	36°	15	46°
		22	46°
		23	45°
25 „ 27	37°	27	44°
28	38°		

Yours faithfully,

Havant, March 4. C. J. R.

The Hot Springs of Rotomahana.

Sir,—To the north-east of Lake Tanpo, in the province of Auckland, New Zealand, lies Rotomahana, a lake only three-quarters of a mile in length and a quarter of a mile in breadth, yet containing points of the greatest interest and beauty. Springs of boiling water rise in the centre and along the banks, neither fish nor shellfish can live in it, but it is a favourite resort of numerous aquatic birds, which build their nests on its warm banks while they find their food in the waters and swamps of the cold lake Rotomakariri.

In the midst of Rotomahana stands the small island of Puai. It is a mere rock 12 ft. high, 250 ft. long, and nearly 100 ft. wide. Here the continual roaring, rushing, boiling sound, combined with the intense heat of the ground impresses one with a feeling of terror. Hot water bubbles up everywhere, and wherever a hole is made in the ground hot steam bursts forth, which is used by the natives for cooking potatoes and meat.

The spring Te Tarata is found at the north-eastern end of the lake, 80 ft. above the level, within a crater 80 ft. long by 60 ft. broad, open towards the side of the lake, and filled up to the brim with clear boiling water, which issues in the centre several feet higher, looking beautifully blue in its snow-white incrusted basin. Enormous clouds of steam are reflected in the blue mirror, and the temperature of the water, while probably reaching the boiling point in the centre, is only 183·2° Fahrenheit near the rim of the basin. The water is neither alkaline nor acid, it has a slightly salt taste, and possesses in a high degree the property of incrustation. The sediment consists of silica, and the overflow has formed on the slope of the hill a system of crystal terraces, which appearing almost as white as marble, present a sight impossible to describe. It is as if a cascade, rushing over steps, had been suddenly arrested and transformed into stone. Each of these steps has a small elevated rim from which hang delicate stalactites, and here and there on the steps, basins filled with crystal water form natural baths, which may be selected at pleasure, deep or shallow, large or small, and of every temperature, those nearest the source being the warmest; some are even large enough to swim in with comfort.

A path from Te Tarata leads through the bush to the great Ngahapu spring. This basin is 40 ft. long and 30 ft. broad, and the water within is in constant agitation. For a few moments it may be quiet in its cauldron, when it again bubbles up and is thrown from 8 to 10 ft. high, a foaming surf of boiling hot waves streaming over the sides of the basin. The thermometer rises in these springs to 208·4°. Further south, and close to the banks, is situated the Te Takapo spring, a boiling water basin 10 ft. in diameter, the Geyser rising to a height of 30 to 40 ft. Near this lies a hollow called Waikana-panapa (variable water), at the approach of which there is danger of sinking in the boiling mud. The cavity itself appears like the crater of a volcano; the walls, bare of vegetation, are rent in pieces, while tongues of rock of white, red, and blue clay, rising up like spectres, threaten every moment to fall. The bottom is formed of fine mud, and silicious stalactites of every form and variety lie about, like pieces of ice after the breaking up of a frozen stream. Here is a deep pool filled with bubbling mud, there a cauldron full of boiling water, near it a dreadful hole which, with a hissing noise, ejects a column of steam; further on small mud hills, from 2 to 5 ft. in height, which, with a dull noise, throw the boiling mud from their craters like miniature volcanoes. In the back ground is situated a green lake named Rotopunamu, an extinct spring.

Lying picturesquely among rocks and bush, on the north side of the cavity, is the spring Rua Kiwi (Kiwi hole). It is an oblong basin of 16 ft. in length, filled with clear simmering water. The banks here assume a steep and rocky character, hot springs bubbling out of them below the surface of the water. Not far off is the intermittent spring Koingo (the sighing), the emission of water only taking place from three to four times a day, and alternating with the neighbouring Whatapaho.

In the flats are several cold-water lakes, and in the background rises a mountain, Te Rangi Pakaru (broken heavens), on the west side of which there streams a mighty solfatara rich in sulphur.

On the western bank the great terrace spring Otuka Puarengi, (cloudy atmosphere) forms the counterpart of Te Tarata. The stalactite steps reach to the lake, and one ascends as on a marble staircase decorated on both sides with green shrubs. These terraces are more delicate than the Te Tarata, and of a beautiful pink hue, which adds a peculiar charm to this wonderful formation. The basin is 40 to 50 ft. in diameter, and appears a calm, blue, steaming, but *not boiling* mirror of water. On the northern side, at the foot of the terraces, is the solfatara Whaka-taratara, a sulphur-pool in the true sense of the word, from which a hot muddy stream runs into the lake.

There are about 25 large hot springs and a number of smaller ones at Rotomahana, which is only one point of a rent above 150 miles long, and 17 wide between the volcano Tongariro, and sulphureous and steam-enveloped White Island.

These thermal springs have proved most efficient in curing diseases of the skin and rheumatism.

I remain, &c., A. R.[1]

Meteorology of February, 1870.—*From* F. B. Falkner.

Sir,—I beg to send you a few particulars of the weather of last month, according to observations conducted by myself in this midland neighbourhood. The circumstances of atmospheric temperature and moisture refer to a stratum of air 4 ft. from the ground. The barometer is 335 ft. above sea-level. The "solar" thermometer has its bulb blackened and inclosed in a vacuum glass chamber; it is used to indicate the power of the sun's rays. The "radiation" thermometer indicates the lowest temperature to which unsheltered vegetation, near the earth's surface, is exposed at night.

General Results.

Mean maximum temperature of air	41·5°
Mean minimum temperature of air	29·1°
Mean diurnal range of temperature of air	12·4°
Greatest range of temperature of air in 24 hours, on the 10th	26·7°
Least range of temperature of air in 24 hours, on the 8th	3·3°
Highest temperature of air, on the 28th	57·4°
Lowest temperature of air, on the 10th	11·4°
Total range of temperature of air	46·0°
Mean temperature of air	35·3°
Mean temperature of dew-point	31·6°
Highest 9 a.m. reading of the dew-point, on the 28th	46·0°
Lowest 9 a.m. reading of the dew-point, on the 10th	13·0°
Total range of the 9 a.m. reading of the dew-point	33·0°
Highest reading of "solar" thermometer, on the 15th	94·0°
Lowest reading of radiation thermometer, on the 11th	2·0°
Lowest maximum temperature of the air during 24 hours, on the 13th	30·7°
Highest minimum temperature of the air during 24 hours, on the 3rd	41·7°
Mean humidity of the air	·86
Mean weight of water in a cubic foot of air	2·1 grs.
Mean height of the barometer	29·553 in.
Highest 9 a.m. reading of the barometer, on the 12th	30·120 in.
Lowest 9 a.m. reading of the barometer, on the 24th	29·060 in.
Observed range of the barometer	1·060 in.
Rainfall	1·370 in.
Number of days that were frosty at 9 a.m.	8
Number of frosty nights	17
Number of nights on which air-temperature fell below 25°	8
Number of nights on which air-temperature fell below 15°	3
Number of days on which air-temperature rose above 45°	9
Number of days on which air-temperature rose above 50°	2

and on one day (viz., the 28th), the temperature of the air rose above 55°, the highest reading of the shade-thermometer on that day being 57·4°.

In the lower regions of the atmosphere northerly winds blew as often as southerly; but easterly winds were more frequent than westerly in the proportion of 5 to 2. Mild weather prevailed up to the 8th day; but easterly and north-easterly breezes were very strong in the second week of the month, and were accompanied by a deep drifting snow and severe frost. The third and fourth weeks were (by comparison) moderate, though there were frequent and sharp frosts at night. On the whole the temperature of the air in February,

[1] Our correspondent has sent us some very exquisite photographs, which give an excellent idea of the district described in the above not less perfect "word-picture."—Ed. *S.O.*

1870, must be regarded as having been about 3° below the *average* mean temperature of the month in the Midland counties. The amount of rain (or melted snow) for the first two months of the current year is considerably in defect of the average for the same period.

I remain, Sir, your obedient servant,

F. B. Falkner.

Appleby Grammar School, Leicestershire, March 3.

British and American Coal-measure Fishes and Reptiles.—*From* T. P. Barkas, F.G.S.

Sir,—There has recently been issued in America, by the authority of the Legislature of Illinois, a work in 2 vols. 4to., entitled *Geological Survey of Illinois*. The contents of vol. ii. are principally devoted to an exposition of the vertebrata, invertebrata, and plants of the carboniferous system of Illinois. The first 141 pages are appropriated exclusively to the fishes and reptiles of the State, which in its geological conformation is to a large extent lower carboniferous.

Of the coal-measure fishes described in the work, the following genera are common to the Illinois lower carboniferous, and the British upper carboniferous strata:—Palæoniscus, Cladodus, Diplodus, Petalodus, Ctenoptychius, Orodus, Helodus, Pœcilodus, and Leptacanthus.

In the Illinois coal-measures one reptile has been found to which has been accreted the name *Amphibamus grandiceps*, the total length of the specimen, including head and the greater part of the body, is but three inches. Similar small reptiles have been discovered in British coal-fields, and the largest and most complete reptile that has yet been obtained in any carboniferous strata, has recently been discovered in the North of England; its total length must have been little short of that of an ordinary Ichthyosaur of the Liassic period, as I estimate, from the large portion now in my possession, that its length could not have been much less than 10 ft., and very probably exceeded that size. In due time a full description of this unique fossil will be given to the scientific world.

I note that *Antliodus minutus*, pl. 3, figs. 3 and 3a, of Illinois Survey, very closely resembles the shorter forms of Climaxodus discovered in the Northumberland coal-shale, and both genera in their leading characteristics somewhat resemble Janassa and Dictea of Munster.

To demonstrate the pressing necessity which obtains for a revision of the present knowledge of Palæozoic palæontology, and a thorough elucidation of what is now known, I may refer to another American work recently published, entitled *Acadian Geology*, by Dr. Dawson, in which an error has crept. In the *Memoirs of the Geological Survey of Great Britain*, "Iron Ores of South Wales," part iii., p. 22, pl. 1, figs. 4, 5, 6, the scales of Rhizodopsis are described and figured as Rhizodus, and the error is repeated in Dr. Dawson's more recent work, pp. 210 and 254, where Rhidodopsis is twice figured as Rhizodus.

In the *Memoirs of the Geological Survey*, already quoted, pl. 1, fig. 7, Cœlacanthus throat plates are figured and described as Rhizodus, and in *Acadian Geology*, p. 254, fig. 77, a jaw is figured as Acrolepis, which does not in the remotest degree resemble the jaw of that carboniferous and Permian fish.

I instance these few facts which are only a few selected from many, to prove, if proof be necessary, that the ichthyological literature of the palæozoic rocks requires a thorough revision, and that the strata demand a complete and systematic investigation by competent observers.

Since I last had the pleasure of contributing to your pages, I have succeeded in obtaining some valuable specimens from the Northumberland coal-field. Among those recently obtained are a splendid mandible, maxilla and premaxilla, of Megalichthys—the mandible is 9 in. long; a large scapula of a reptile; a portion of a pelvic bone, with a cavity for the articulation of a femur, the cavity being 1⅛ in. in its longer, and ⅞ in. in its shorter, diameter.

I have also obtained three perfect plates similar to some that have been described as opercular plates of Rhizodus. The three plates pretty closely resemble each other in form and surface markings, but differ very materially in size. The smallest of the plates is 1¾ in. by ¾ in., the next is 6 in. by 2 in., and the largest, which is probably the largest that has yet been found, is 7¾ in. by 2¾ in.; all are perfect, they very closely resemble in form the clavicle of a cod, and it is yet a fairly open question whether they be clavicles or operculæ. The fish to which they belong is also undetermined, as it has not yet been satisfactorily settled, notwithstanding the discovery of large teeth in the Northumberland coal-measures, whether undoubted remains of Rhizodus have been found in our North of England coal formations.

I am yours obediently,

Newcastle-on-Tyne, March 3. T. P. Barkas, F.G.S.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

Thursday, March 3rd.—The following papers were read:—"Results of the Monthly Observations of Dip and Horizontal Force made at the Kew Observatory, from April 1863 to March 1869 inclusive," by Balfour Stewart, F.R.S., Superintendent of the Observatory.—In a communication made to this society by the president, Sir E. Sabine, and published in the *Philosophical Transactions* for 1863, p. 273, we have the results of the monthly observations of Dip and Horizontal Force made at Kew for the six years ending March, 1863. In the present communication it is proposed to reduce in a similar manner the results of the following six years.

The mode of observation has already been so fully described by Sir E. Sabine that no further account of it is necessary, suffice it to say that in October, 1863, Mr. Chambers left the Observatory for India, and that Mr. George Whipple took his place as magnetical assistant. Mr. Whipple has since continued to observe every month, with the utmost care and assiduity, employing the same instruments that were used by his predecessor, and the same methods of observation and reduction. A smaller number of observations by other instruments and other observers have likewise been made, but it has been thought desirable to limit this discussion to the series made by the regular observer. I ought likewise to state that both the dip-circle and unifilar stood in need of slight repairs, and that they were put into the hands of optitians for this purpose; the first observation with the repaired dip-circle being that of January, 1869, and with the repaired unifilar that of December, 1868. [The records are then given seriatim.]

"On the Nebula of Argo, and on the Spectrum of Jupiter," by A. Le Sueur; communicated by Professor G. G. Stokes, Sec. R.S.[1]—Among the following observations made with the great Melbourne telescope, the most important are those of η Argo; the spectrum of this star is crossed by *bright lines*.

The mere fact of a bright-line spectrum is not very difficult to ascertain on a good night; for although from faintness of the light the phenomenon is necessarily delicate, yet the bright line occasionally flashes out so sharply that the character of the spectrum cannot be mistaken. The most marked lines I make out to be, if not coincident with, very near to C, D, *b*, F, and the principal green nitrogen line. There are possibly other lines, but those mentioned are the only ones manageable.

Direct spark comparison has hitherto been found impossible; though plainly marked at moments, the lines require concentrated attention, and will not permit the disturbing effect of other light in the field; attempts were made to diminish the brilliancy of the spark spectrum but with no good result, a different method was therefore adopted.

By watching for good moments the pointer was placed on a particular star-line, the spark spectrum was then turned on, and the position of the pointer noted.

By this means it was seen in repeated trials that star-lines within the limits of the dispersion used (about 7°) were coincident with C, F, the principal green nitrogen line, and *b*, or rather (the spark employed was platinum in air) the air-band involved in *b* group. It cannot be determined whether the coincidence is with the magnesium group or the air-band; nothing more definite can be said than that the star-line lies within the limits of the group.

The comparison spectrum employed does not show F, but the position of the previously adjusted pointer, with reference to air-lines in the neighbourhood, leaves little doubt as to the identity of the blue star-line with F, due regard being had to the collateral evidence (when such close limits are reached) that C coincides with a red star-line. The yellow (or orange ?) line in the star has not yet received sufficient attention, it is, however, very near D.

With the dispersion employed, D and the bright air-line, or less refrangible side of D, are well separated; so that, notwithstanding the delicacy of the star-line, I hope, if not to get satisfactory evidence of coincidence with a particular line, at least to eliminate one of the competitors; at present, it cannot even be said whether the line may not be slightly more refrangible than D. The limits are, however, very small, placing the bright air group, about 1180 of Mr. Huggins's scale, completely outside the possible range.

I would remark that the very faint nebulosity (if any) in the immediate neighbourhood of the star η is incompetent to give a trace of spectral lines with even a wide slit; for a considerable space S and *f* of η no lines are at all visible; the nearest nebula bright enough to

[1] We are unable to reproduce the diagrams sent with this paper; but as the text is sufficiently plain to astronomers, we prefer to reproduce it as it is to cutting it out altogether.—Ed. *S.O.*

show a line (the three usual lines are now easily seen on a good night over the brighter parts) is reached in the direction about 45° N p from η, and even then the distance from η, as judged by the appearance in the spectroscope with η threaded on the thus directed slit, is little less than one minute. This remark is of some importance in connection with the ordinary telescopic observations of the nebula, but is mentioned at this point to relieve any impression which might arise that the nitrogen line seen on the star spectrum is merely the chief nebula line crossing it.

In the present state of the inquiry there is little doubt left as to the presence of hydrogen in the star; the other lines may perhaps be accounted for by nitrogen alone, or by nitrogen, magnesium, and sodium.

On the whole the weight of collateral evidence will probably be considered to be in favour of the latter combination, with the possibility that for sodium may have to be substituted the substance which produces the line in sun-protuberance spectrum.

For although there is no direct evidence as to identity of the line near D, if the coincidence were with the orange nitrogen line, it would be reasonable to expect a line in the star corresponding to the yellow line 1180±, yet none has been made out in that position; again, the second green line has probably less claims for visibility than the orange or yellow lines, yet in the star spectrum this line is not less well seen than that coinciding with the chief nitrogen line; these considerations, though perhaps not entitled to great weight, at least lead in the direction of the above inference.

Owing to faintness of the general spectrum, no dark lines are made out; one in the red is strongly suspected, and occasionally there is an appearance as if of a multitude over the spectrum generally, but they refuse to be seen separately and certainly.

It is fortunate that these observations have been possible in the present magnitude of the star. May not the bright-line character of the spectrum be due to a commencement of increase in the star?

I extract the following estimation from the Melbourne observations:—

			Mag.	
1863.	Oct.	14	5	The estimations are by Mr. White, who has charge of the Transit Circle. Mr. Ellery estimated last year as a 6½+, and now thinks it is somewhat brighter.
1864.	May	6	4·5	
„	„	19	4·5	
1865.	„	22	4·5	
„	June	14	4·5	
1868.	April	21	4	
„	May	27	4	
„	„	26	5	
1869.	„	2	6½	
„	„	11	6½	
„	„	30	6	

At an earlier stage of the observations with the Melbourne reflector, I was on the whole inclined to think that the difference between the view of the nebula about η Argo as seen with the 4-ft. reflector, and that seen by Sir J. Herschel with his 18-in., though strongly marked in the neighbourhood of η, was yet, due regard being had to aperture and other disturbing causes, capable of being accounted for without going to the length of assuming such enormous changes as would result if the sketches represented the true facts in both cases. It was thought that the presence of the star η might have a large disturbing effect, increased by aperture, and that therefore an erroneous impression might be formed of the configuration and character of the nebula in its proximate neighbourhood. (The trapezium of Orion, as will be seen from observations to be presently recorded, is a case in point)

The spectroscope has, however, decided that η in no way influences the configuration as now seen; the star is not only apparently but really on a background if not completely dark, at least free from nebulosity at all comparable to the brighter parts; moreover, the nebulosity at S end of lemniscate (the shape there is occasionally made out, showing that nebula does exist) is of a similar faint character.

With this evidence, that the eye-view with the 4 ft. approaches the actual facts, and a due consideration of those facts, it seems difficult to imagine any conditions of aperture, definition, or other disturbing causes which could produce a view at all approaching to that seen by Sir John Herschel.

We have, therefore, evidence of much weight that enormous changes have taken place in this wonderful region. Is not the presence of nitrogen and hydrogen in the star η a significant fact in connection with these changes, which appear to be nothing less than a destruction of nebula specially in its neighbourhood?

Orion has been examined with a new and interesting result; the spectroscope proves that in and about the trapezium nebula exists comparable with the bright surrounding nebula.

This observation is rendered easy by the large separation of the stars consequent on great focal length of telescope; indeed, the whole separation of the original image is not required, the observation being made more crucial by a condension of between two and three times; with this arrangement the separation is still sufficient, and the advantage is gained of viewing at the same time the bright surrounding nebula.

The stars, sharply focussed to give a linear spectrum, being threaded on the slit singly or in pairs, or cautiously removed out of the field, it is seen that the bright lines cross the trapezium with little if at all diminished brilliancy.

The ordinary telescopic view is therefore an erroneous one, produced by the disturbing effect of the bright group.

Jupiter has been examined (generally on moonlight nights); with this object the original Cassegrain image is too faint for good work, but by interposition of a suitable lens the image is condensed at pleasure within certain limits; with the light thus increased the Fraunhofer lines G, F, *b*, E, D are always easily seen, C also easily on a clear night; the lines to which special attention has been directed are the telluric lines 914 and 838 (for convenience of reference I use throughout the numbers in Mr. Huggins's Jupiter and sky diagram). These are the only lines seen with certainty between C and D.

The identity of 914 and 838 rests partly on measures and partly on spark comparison, where, for the identification of 914, it is seen that this line is near to the air-band 807 of Mr. Huggins's chemical scale.

The line 914 is so easily seen, that, having in mind Mr. Huggins's statement concerning the difficulty of discerning it at all—originally very imperfect measures, on a bad night, and with the apparatus imperfectly adjusted, misleading in the same direction,—this line was at first mistaken for 882, from which, however, it is separated far beyond the limit of error in a proper state of adjustment of apparatus.

882 is not seen at all with Jupiter at considerable altitude. On the night of December 29th, however, between the hours of 12.30 and 1, Jupiter being low, 882 was then seen almost as conspicuous as 914, which, I may remark, did not seem to have perceptibly increased in darkness by the additional absorption of the earth's atmosphere.

On the night of December 14th (both objects being near the meridian) the spectroscope was turned on Jupiter and the moon alternately several times. On Jupiter 914 and 838 were easily visible, the former (as usual) the more conspicuous; on the moon no line could be certainly made out between C and D. Mr. Ellery was present at the time and gave the same verdict.

So far these observations are merely confirmatory of those made by Mr. Huggins. There is one point, however, not unworthy of consideration, arising from a comparison of the observations in connection with the conditions under which they are made.

It is probable that Mr. Huggins, with his earlier apparatus, was under more favourable conditions as regards light than, if not the best at my command, at least than those under which 914 is now plainly seen. When condensed as much as arrangements allow (about four times), I probably get a somewhat brighter image at the slit than that produced by Mr. Huggins's telescope; but with little or no condensation, and a dispersion of near 7° (B to H = 6° 50′), the line in question is still conspicuous. Yet Mr. Huggins speaks of this line as barely distinguishable, or not at all visible with his earlier apparatus. Width of slit, of course, plays a prominent part; but I cannot be wrong in assuming that, for prospecting purposes, Mr. Huggins tried various widths. Moreover, when the slit is gradually cut down, 914 is visible as long as the chief Fraunhofer lines, and is still readily seen when the light is insufficient to show a trace of C or 838 near it.

These considerations, if not entitled to much weight, at least point to a possible variability of the line in question. If this prove to be the case, it will be interesting to note its degree of visibility in connection with the character of the surface at the different times of observation.

I cannot find whether 914 or 838 involve the lines proved by M. Jansen as special to aqueous vapour. An answer one way or the other would be equally interesting; for Mr. Huggins's observations and my own later ones (which are indeed merely corroborative) go far to prove that, whatever the cause of the lines, that which produces 914 and 838 has on Jupiter more efficacy than that which produces 882, while the reverse appears to be the case on the earth.

Jupiter was taken in hand specially to note any peculiarity in the spectrum of different parts of the surface, as regards general or specific absorption. The best observations were made on the night of December 11th, when the phenomena were as given in the diagram, to which the second figure of Jupiter is added merely for any additional interest to be derived from two views on the same night (*a* at 9.30, *b* at 11.30±).

The space N P is slightly yellowish, and appears at good defining moments to be crossed by a multitude of fine hair-lines (this has been seen more than once); P Q is white, and considerably brighter than the general surface; Q R dusky yellow, much darker than N P; R T white; T S similar to P Q, but more approaching to white.

P, Q, R, T, dark brown with occasional suspicion of green tinge.

The spectrum, as given in the diagram, is an inversion (to suit telescopic image of planet) of what is seen in the spectroscope with the slit perpendicular to Jupiter's equator.

The absorption of Q, R is most marked beyond F, fading gradually

away to about E; beyond this Q, R are seen separately with an apparently undiminished spectrum between them; P Q is much brighter than the general spectrum and is normal throughout; T R occasionally flashes out brightly; P stretches equally across the spectrum; T is most marked at the less refrangible end (the reverse of this was the case for one of the belts on a former occasion).

A special point aimed at in these observations was to note any peculiarity in the lines 914, 838 as they cross the various parts of the surface in this position of the slit, but no satisfactory evidence could be elicited. As before mentioned, by the interposition of a suitable lens the image, still focused on the slit, may be condensed at pleasure within certain limits; a point is therefore chosen at which the compromise between brilliancy of spectrum and size of image is deemed most suitable for the object in view. The light is quite adequate for the purpose; when the bands T Q, Q R are still of considerable width, any difference, if not very slight, in the line 914 as it crossed the different bands ought therefore to have been detected. This was not the case. The experiment was tried of placing the slit parallel to the bands, but with no new result.

"Spectroscopic Observations on Stars and Nebulæ made with the Great Melbourne Telescope," by A. Le Sueur; communicated by the Rev. T. R. Robinson, D.D.—This was another communication containing numerous records of observations, but is too long for abstract in these pages.

GEOLOGICAL SOCIETY OF LONDON.

FEBRUARY 23RD.—Joseph Prestwich, Esq., F.R.S., president, in the chair. Alexander G. H. Harding, Esq., of King's College, and 39, Woburn-place, Russell-square, W.C.; Thomas Adair Masey, Esq., Barrister-at-law, 6, Crown Office-row, Temple; and Samuel Haslett, Esq., Ann-street, Belfast, were elected fellows of the society. The following communications were read:—

"Additional Observations on the Neocomian Strata in Yorkshire and Lincolnshire, with Notes on their relations to the Beds of the same Age throughout Northern Europe," by J. W. Judd, Esq., F.G.S.—This paper embodied the results of the author's further study of the Neocomian beds of the north of England, in connection with those of North-western Germany.

The inland development of these strata in the Vale of Pickering was described as being greatly obscured by superficial deposits. The beds, however, exposed at Reighton, West Heslerton, and Knapton were shown to agree, both in physical and palæontological characters, with several of those before described in the cliff section at Speeton.

The Neocomian ironstones of Lincolnshire have, since the date of the former paper on the subject (1867), been extensively opened out by mining operations; and the valuable and instructive sections thus afforded were described in detail. A general sketch was then given of the range and characteristics of the Neocomian strata in Yorkshire and Lincolnshire.

Evidence was next adduced to show that strata of the same age, and remarkably similar in character, had been deposited over a very wide area in northern Europe. Throughout the whole of these districts, however, the Neocomian strata were very inadequately exposed, and afforded no good general sections; and the Speeton Cliff thus acquired an additional interest from the fact that it forms a valuable, and almost the only, key whereby we can correlate the beds over this vast area.

Studying the continental deposits in this manner, by the aid of the Speeton section, the fossiliferous clays of the island of Heligoland were shown to belong to the "Zone of *Ammonites Speetonensis*." *i. e.*, the upper part of the Lower Neocomian. The boulders found in the drift deposits of Holland were referred to as evidence of the former wide extension of limestones similar to those of Tealby in Lincolnshire. In Westphalia the sandstones, limestones, ironstones, and clays, so extensively developed in the hills of Bentheim and the Teutoburger Walde, where shown to be of Middle Neocomian age, while certain beds of clay in the same district were referrible to the Upper Neocomian. In Hanover, the "Hilsthon" of M. Fr. Ad. Römer was shown to be in its upper part Upper Neocomian, and in its lower part Middle Necomian, the latter passing locally into beds of oolitic ironstone, sandstones, and limestones, precisely similar to those of the same age in Lincolnshire. The narrow strip of highly-inclined Neocomian strata along the northern foot of the Hartz was shown to belong to the same two subdivisions. In Brunswick, however, the Neocomian series was more complete, for underneath some 400 ft. of clays, which on palæontological evidence clearly belong to the Upper and Middle divisions, there were certain marly limestones, in places becoming ferruginous, containing an abundant and interesting fauna, which was most unmistakably that of the *Lower* Neocomian.

It was then pointed out that in northern Germany there was evidence, as in this country, of an unconformity existing between the Upper Cretaceous and the Neocomian, as well as between this last and the Jurassic. Attention was also drawn to the fact that while the Neocomian series was complete in Yorkshire and Brunswick, its lowest member was absent in the intermediate districts, being apparently replaced by the freshwater deposits of the German Wealden.

Discussion.—Mr. Etheridge stated that he had examined sections in Brunswick and Hanover, at Hildesheim, and other places, and confirmed Mr. Judd's results. He remarked upon the occurrence of *Pecten cinctus* in the Middle Neocomian in England, and in the Lower Neocomian in Germany.

Sir Charles Lyell noticed the occurrence of anticlinals and contortions in the Brunswick district, and remarked upon the comprehensiveness now ascribed to the "Speeton Clay," and on the correspondence of the phenomena observed in Yorkshire with those presented in the south of England, in passing from Folkestone to the Isle of Wight. He also mentioned the occurrence of *Ammonites Deshayesii* in the Hastings sand at Punfield, as indicating the marine and cretaceous nature of that deposit.

The president inquired as to the evidence of the representation of the Lower Neocomian by Wealden deposits in Germany.

Mr. Judd remarked that the Punfield marine band is absolutely inclosed in the Wealden, and that its fossils have an Upper Neocomian character, with a clear affinity to a Spanish series. He regarded the Wealden of North Germany as not strictly contemporaneous with that of England, and stated that the "Hilsconglomerat" in Brunswick was a shore deposit, but that its correlation with the Wealden was impossible.

2. "On Deep-mining with relation to the Physical Structure and Mineral-bearing Strata of the S.W. of Ireland," by Samuel Hyde, Esq.; communicated by R. Etheridge, Esq., F.G.S.—The author described the general structure of the country in the south-west extremity of Ireland, which he stated to consist of a series of rocks analogous to the "Killas" of Cornwall, and belonging to the upper part of the Lower, or the lower part of the Upper Devonian series. He combated the opinion which had been expressed by the late Professor Jukes, that copper ores would not be found in the district in sufficient quantities to make mining there a remunerative process. In support of his thesis, he cited the Bearhaven mines, established about fifty years ago, the Allitries and Ballycummisk mines, and the Coosheen mine. He stated that in the Ballycummisk mines a depth of 200 fathoms has been reached, and that some of the shafts at Bearhaven are much deeper. These deep workings were said to yield large returns of ore. In opposition to the opinions stated by the late Professor Jukes, the author maintained that the copper lodes were of the same nature as those of Cornwall, and he described them as running in a similar direction, namely, 10°–25° N. of E. From the similarity in the geological constitution of the country, and in the direction of its mineral veins, the author was inclined to infer a former continuity between the south-western promontories of the islands of Great Britain and Ireland.

Discussion.—Mr. David Forbes protested against the notion that the Devonian strata themselves were metalliferous, the veins being of much later date—in the present case Post-carboniferous. He maintained that there was no valid reason for supposing that the veins became unproductive with increased depth, and opposed the notion that they had been filled in by the segregation from the surrounding rock. He alluded to the use of spectroscopic analysis in such inquiries, and remarked that as no trace of copper is to be found in the rock even immediately adjacent to veins, we should have to admit, on the hypothesis of segregation, that the rock must originally have contained precisely the amount of metal segregated in the veins.

Mr. Etheridge agreed with Mr. Forbes as to the date of the filling in of the veins. He also maintained the justice of correlating the rocks with those of the Cornish area.

Mr. Hyde briefly replied.

The following specimens were exhibited:—Rocks and minerals from the south-west of Ireland; exhibited by Samuel Hyde, Esq.

ZOOLOGICAL SOCIETY OF LONDON.

FEBRUARY 24TH.—Dr. E. Hamilton, V.P., in the chair. A communication was read from Mr. R. Swinhoe, F.Z.S., containing some information on the subject of the exact locality of the Amherst's Pheasant (*Thaumalea Amherstiæ*), which was stated to be the mountains between the Chinese province of Sechuen and Thibet.

A letter was read from Sir George Grey, K.C.B., in reference to Professor Owen's communication of a letter from Dr. Haast read at the previous meeting. Sir G. Grey was of opinion that there were good grounds for believing that the Dinornis had been extirpated by the direct ancestors of the present race of Maories.

A second letter was read addressed to the secretary by Mr. W. H. Hudson on the ornithology of Buenos Ayres.

Mr. Sclater exhibited a specimen of a new Lemur, which had been lately discovered by Mr. van Dam in North-eastern Madagascar, and had been named by Mr. Pollen *Propithecus damanus*.

Messrs. C. H. T. and G. F. L. Marshall read some notes on the classification of the birds of the family Capitonidæ.

Two communications were read from Mr. R. Swinhoe, F.Z.S.,

on the White Wag-Tails (Motacillæ) of China, and on a new species of Accentor from Northern China, proposed to be called *A. erythropigius*.

Mr. P. L. Sclater read a paper on the Deer living in the Society's Menagerie, amongst which there were stated to be examples of several recently described and very little-known species. Mr. Sclater concluded his paper with remarks on the arrangement and the geographical distribution of the Cervidæ, and in particular of the species of the genus Cervus. The total number of Cervi recognized as probably valid species were 23 in the Old World, and 17 in the New World.

ANTHROPOLOGICAL SOCIETY OF LONDON.

MARCH 1ST.—Dr. Beigel, V.P., in the chair. Robert Wright, Esq., and R. H. Hilliard, Esq., M.D., were elected fellows.

Major Frederick Millengen read a paper "On the Circassian Slaves and the Sultan's Harem."—The paper began with an historical review of slavery, showing by what means the Turks insured to themselves in former days a supply of white slaves, so as to recruit their armies and their harems. Having recoiled, however, before the victorious arms of Christendom, the Turks fell back on Circassia, from which country they continued, till lately, to draw a good supply of fair slaves. Since 1864, when Russia expelled the Circassians from their country, the slave trade has by no means ceased to exist; on the contrary, the slave-supplying Circassians having made a junction with the slave-buying Turks and Egyptians, the trade has augmented instead of decreasing. The facts stated by the author with regard to the slave trade seemed to prove that, from the highest to the lowest, all the ladies of Constantinople, those at least who have capital to invest, are regular slave-dealers. The author subsequently showed that the use of white slaves is a necessity for Mussulman nations on religious, social, and state-policy reasons, as slavery serves to keep women under subjection and in a state of seclusion; while politically it is indispensable for the maintenance of the reigning dynasty, whose matrimonial alliance with any other but slaves is against the statute of the Empire. A description of the Seraglio then followed, its organization being accurately exposed, while ample details were given concerning the wives and odalisks of the Sultan. In the Seraglio the lot of the Circassian slaves was said to be better than that which befalls the generality of slaves; there they are provided with everything, and can attain high honours and power.

On the whole, however, the system was condemned by the author on account of its being a source of ruin and depravity for both slave and master. With regard to the suppression of slavery, the author maintained that it is impossible that the Turks should seriously think of doing away with it, for the reason that slavery in Turkey is so much a part of the social and political edifice that an attempt to alter the existing state of things would inevitably hasten its downfall. In conclusion, he touched upon the emigration question, and argued, that if the Turks, instead of importing women and good for nothing slaves, had given their minds to peopling their half-deserted country with an immigration of hardy and industrious men, Turkey might be now at the head of the civilized countries of the earth.

Mr. E. Charlesworth exhibited some remarkable flint implements from Honduras.

ROYAL INSTITUTION OF GREAT BRITAIN.

GENERAL MONTHLY MEETING, MONDAY, MARCH 7TH.— Colonel P. J. Yorke, F.R.S., in the chair. H.R.H. the Prince Christian of Schleswig-Holstein was elected an honorary member. William Henry Barlow, Esq., F.R.S., Arthur John Booth, Esq., Francis W. Buxton, Esq., Joseph T. Clover, Esq., F.R.C.S., Rev. John Congreve, M.A., George Howard Darwin, Esq., the Lord Ronald Gower, M.P., Francis Galton, Esq., F.R.S., F.G.S., Robert Grubb, Esq., John Gurney, Esq., Henry Hoare, Esq., James Houldsworth, Esq., Lieut.-Colonel Gordon Ives, Thomas Jacomb, Esq., Edmund C. Johnson, Esq., Sir John James Trevor Lawrence, Bart., Frank McClean, Esq., M.A., John O'Halloran, Esq., Hervey Pechell, Esq., Frederick Pennington, Esq., George Phillips, Esq., Marlborough Robert Pryor, Esq., John Rae, M.D., Rev. David Mede Salter, M.A., Albert George Sandeman, Esq., George Stone, Esq., Algernon A. de Lille Strickland, Esq., Charles Bosworth Thurston, Esq., F.S.A., the Hon. John Gage Prendergast Vereker, Mrs. Michael Wills, Henry Woods, Esq., M.P., were elected members of the Royal Institution. The special thanks of the members were returned for the following addition to the "Donation Fund for the Promotion of Experimental Researches":—Arthur Giles Puller (4th Donation), £21. The presents received since the last meeting were laid on the table, and the thanks of the members returned for the same.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

AT the meeting held February 8th, a paper was read by Mr. T. Fiddian "On a New Method of Adjusting the Focus of Microscopes."—The paper commenced by pointing out the difficulty which the manufacturer of compound microscopes, from their first construction in 1661 up to the present time, had to contend with, in the rapid and accurate adjustment of the focus. Notwithstanding the perfection to which the "rack and pinion" adjustment has been brought, it is still a very imperfect method of adjusting the focus of microscopes. This arises from two causes. In the first place, the motion is not continuous. As the teeth of the pinion successively come into contact with those of the rack, they produce a motion not strictly even and uniform, but intermittent, so that the instrument cannot be easily and accurately brought to rest at any given point, unless such point happen to be within the range of one of the teeth, and not between the range of two teeth; therefore this movement can be relied on for an approximation only to the exact focus. Secondly, the very small surface of metal used in the rack and pinion causes it to wear out speedily and become uneven, and consequently less accurate in its action, and, should a tooth break off the rack, it renders the microscope quite useless until repaired. To remedy these defects, and therefore to produce increased durability and accuracy, Mr. Fiddian has contrived and adopted a "screw motion," the mechanical arrangements of which were clearly pointed out by the author, and further elucidated by a model and lithographic drawings.

The meeting on the 15th Feb. was devoted to a conversazione and exhibition of specimens. Mr. Bagnall handed in to the society, on behalf of the members of the botanical section, a list of plants found within ten miles of Birmingham. Seventy-nine natural orders were represented, comprising 689 species and varieties, the whole being collected during the years 1867-69. On the 22nd February the Rev. W. H. Painter read a paper "On Fossil Cephalopoda."—He commenced by remarks on the importance of comparative palæontology, as it is by the study of that science that we become acquainted with the different changes which have taken place in the fauna of our globe. The anatomy of the class, and their position in the animal kingdom, was referred to. Allusion was made to the Argonaut as being especially interesting, connecting as it does the past with the present, being found now in the Chinese seas, whilst remains have been discovered in the sub-apennine tertiaries of Piedmont. It was to this cephalopod that the ancients assigned the honour of having suggested to mankind the possibility of navigating the sea by means of sails, by the manner in which it was thought to use its dorsal arms: a pleasant illusion which modern research has served to dispel. The paper was illustrated by diagrams and a collection of fossils, including *Orthocera ludensi*, *Phragmoceras ventricosum*, *Ammonites lautus*, *Hammites attenuatus*, *Belemnites hastatus*, and a series of *Goniatites Listeri*. Mr. Allport also contributing specimens of Orthoceras and Litnites from the Upper Silurian shale of Dudley, and a series of Ammonites from the lias, Oxford clay, and upper greensand.

At the meeting on March 1st a long and interesting letter was read from Mr. B. J. Glainville, a corresponding member of the society and curator of the Albany Museum, Graham's Town. It contained details of the carnivorous habits of a large gasteropodous mollusk, *Helix Krausii*, a species obtained in the Klooss in the neighbourhood. Having placed it in a box with a small tree-frog, he found, to his surprise next morning, that there was nothing remaining of the frog but its backbone and one of its hind legs, while the snail was so distended as to be unable to retract itself entirely within its shell.

The following are some of the specimens exhibited at the meetings:—

By Mr. Bagnall, the rare moss, *Mnium stellare*. By Dr. Braithwaite, *Grimmia elatior*, a new species, and *Cynclidium concinnum*. By Dr. Griffiths, *Grimmia spiralis*, *Mnium spinosum*, and *Dissodon splachnoides*, and the three rare lichens, *Opegrapha varia*, *Cladonia furcata*, and *Collema nigrum*. By the president, an interesting collection of Australian plants. By Mr. W. B. Latham, a second series of Arctic plants, collected by several explorers in those regions. By Mr. G. S. Tye, several species of mollusks of the genus Murex, forming the third part of a collection of shells kindly presented to the society by Mr. Keen, Liverpool. By Mr. C. Pumphrey, some singular cylindrical bodies from *Bulimus acutus*, and stellate hairs of *Aralia papyrifera* (the Chinese rice-paper plant). By Mr. A. W. Wills, *Cyclops quadricornis*, with Epistytes and Vorticellæ parasitic, both showing Acineta or Podophrya forms of alternate generations.

YORKSHIRE NATURALISTS' CLUB.

THE ordinary monthly meeting of this club was held on Wednesday evening, 2nd March, at Mr. Graham's, Market-street, York; the Rev. G. Rowe, M.A., in the chair.

The *Transactions of the Zoological Society of London*, vol. vi., pt. 8, and vol. vii., pt. 1, were presented to the library of the club by Basil T. Woodd, Esq., of Conyngham Hall, through the treasurer, Mr. E. Smallwood. On the motion of the Rev. G. H. Hewison, seconded by Mr. E. Robinson, the special thanks of the club were offered to Mr. Woodd for his valuable donation.

Mr. Graham exhibited three fine male goosanders (*Mergus merganser*), one of which had been sent to him for preservation by Sir James Walker, Bart., of Sand Hutton, near York; also male and female of the red-breasted merganser (*Mergus serrator*) sent to him by Mr. Newton, Pickering Marishes, near Malton; and a fine male specimen of the bean-goose (*Anas segetum*), sent to him by the Hon. A. O. Powlett, Bolton Hall, near Bedale. Mr. Graham remarked that this was the first specimen of the bean-goose that he had had in the flesh.

The Rev. G. H. Hewison brought for exhibition, in spirits of wine, a very fine locust from Brazil, and two centipedes from India—species not yet determined.

Mr. J. F. Walker, F.G.S., exhibited the femur of *Ichthyosaurus Walkeri*, from the Cambridge greensand, Cambridge, and made some remarks thereon. He said that the Ichthyosauri first appeared in the liassic formation, and became extinct at the close of the cretaceous period. All the remains of this genus found in the Cambridge greensand have been referred to the genus *Ichthyosaurus Campylodon* (Carter); but there are in the Woodwardian Museum, Cambridge, remains of these animals which would indicate at least five species. The species *Ichthyosaurus Campylodon* was founded on the peculiar form of the teeth, but it is generally admitted that these animals are best classified according to the form of their humeri and femora. He presented to the Woodwardian Museum a cast of a femur (the original bone is in his collection) which has been named by Mr. Seeley *Ichthyosaurus Walkeri*, and has thus been described by him in his catalogue of the reptiles in the University Museum:—"This femur differs more from the other specimens than they do among themselves, chiefly through the suppression of the trochanteroid processes at the proximal end making the head circular, but the wing-like trochanteroid processes persist down the whole length of the shaft; the posterior process is the most elongated."

Mr. Carrington exhibited a fine variety of the moth *Acronyzta tridens*, in conjunction with a typical specimen, both captured near York.

The Rev. J. F. Blake showed the eggs of *Bulimus sp.*, sent to him from Trinidad.

Mr. C. Wakefield exhibited remarkably fine specimens of three not uncommon species of shells, *Odostomia unidentata*, *O. spiralis*, and *O. rissoides*, which he had found in sand dredged off the Dogger Bank.

W. Procter, Esq., M.D., F.C.S., then proceeded to read a paper "On the recent Deep-sea Dredgings." The paper was well illustrated by diagrams, and numerous beautiful specimens of foraminifera were exhibited under the microscope.

On the motion of Mr. S. W. North, seconded by Mr. W. C. Anderson, a vote of thanks was passed to Dr. Procter for his very interesting and instructive paper.

YORKSHIRE PHILOSOPHICAL SOCIETY.

On Tuesday, March 1st, the monthly meeting of this society was held at the Museum, York, the chair being occupied by R. Davies. Esq.

S. W. North, Esq. (in the absence of the honorary secretary, T. S. Noble, Esq.), read the minutes of the previous meeting, and also list of the following specimens which had been presented:—Cast of femur of *Ichthyosaurus Walkeri*, from the Cambridge greensand, Cambridge, presented by Mr. J. F. Walker; large stone hammer from Rigg Hall, presented by the Rev. J. F. Blake; and a half-crown of Louis XVI., year 1792, presented by the Rev. Canon Hey. Mrs. Pease, of Minster Yard, was elected a member of the society.

Dr. Procter read a paper "On the Relations of the Atlantic Deposit to the Cretaceous Beds."—He alluded to the discoveries which had been made by deep-sea dredgings, the conclusion arrived at being that the chalk of the cretaceous period was now forming at the bottom of the Atlantic. At the greatest depth of that ocean there had been found a soft mealy substance, which, when dry, presented very much the appearance of chalk. He described the organisms of this substance, and said that in an analysis he had made of a portion of it taken from a depth of 1,140 fathoms in the Atlantic, he had arrived at the result that the quantities in 100 parts were as follows:—Silex, 25·60; oxides of iron and phosphate, 3·80; carbonate of lime, 57·81; carbonate of magnesia, 1·70; soluble salts, 6·10; organic matter, 2·49; and water, 2·50. The similarity of chalk with this substance was very great, and there was a striking analogy between that which was going on in the Atlantic and the cretaceous beds.

The Rev. J. Kenrick read a notice of "A Roman Sarcophagus lately discovered near Westminster Abbey, and bearing a Sculptured Cross."

Dr. Gibson proposed a vote of thanks to the donors of specimens and books, and to Dr. Procter and the Rev. J. Kenrick for their papers. The Rev. A. R. Fausset seconded the motion, which was carried. A vote of thanks having been given to the chairman, the meeting separated.

ROYAL IRISH ACADEMY.

A general meeting of the Royal Irish Academy was held last week at their house, 19, Dawson-street, Sir Robert Kane in the chair.

Professor J. P. O'Reilly read an interesting paper on a suspension barometer, a model of which he exhibited. The principle of the instrument, which is self-registering, is to indicate the change in atmospheric pressure by weight. The barometer is fixed in an inclined position on knife edges like a balance, and oscillates according as the atmosphere rises or falls. Attached to it is a large needle, which indicates on an arc the oscillations. The instrument is well adapted for exhibiting changes in pressure in public places, as in ports, &c.

The secretary (Professor Sullivan) read a note by Professors King and Rowney, of Galway, supplementary to a former paper on "*Eozoon Canadense*."[1]—The note is descriptive of two specimens, one from Aker, Sweden, and the other from Amity, New York. The Aker specimen is a crypto-crystalline mass of calcite, inclosing numerous lobulated grains of coccolite, respectively identified with the "supplementary skeleton" and "chamber casts" of this reputed organism in its "acervuline" form. Their presumed organic origin, however, is clearly a fallacy, as the grains of coccolite display unmistakable evidences of having been originally crystals that have had their edges, solid angles, and faces, more or less rounded off by some dissolving agent. Imbedded in the calcite are numerous long crystals of what appears to be malacolite, lying about singly and in aggregations. In most instances the crystals have lost some or all of their planes, angles, and edges, so that many present themselves under the massive contorted cylindrical forms peculiar to the so-called "stolons;" others, through prismatic cleavage, are broken up into slender prisms, which, in numerous instances, are reduced by erosion; and further division, to simple and branching configurations, assuming all postures and modes of groupings. The latter match in beauty the finest examples of the "canal system" seen in typical "eozoonal rocks" occurring in Canada. The Amity specimen consists of a similar calcareous matrix, holding crystals of spinel, malacolite, and other minerals. In one of the crystals of spinel, an octahedron, about 2½ in. in its axial diameters, the planes exhibit numerous irregular cavities and linear chinks filled up with crypto-crystalline calcite; in the latter substance, *thus situated*, there are numerous beautiful examples both of "stolons" and "canal system,"—all clearly originating from crystals of malacolite.

CORK CUVIERIAN AND ARCHÆOLOGICAL SOCIETY.

The sixth meeting of this society for the session *1869-70* was held in the library of the Royal Cork Institution, on Wednesday evening, 2nd inst., J. B. Brenan, Esq., V.P., in the chair.

Dr. Caulfield read extracts from a letter written at Mallow by Sir Warham St. Leger, Lord President of Munster, dated 15th January, 1629, and directed to the Lords of the Privy Council. This letter contains an account of the Roman Catholic places of worship in Cork at that time; as also their localities. The original is in the State Paper Office, London.

Mr. Hodder M. Westropp exhibited a bronze loop of a shield found in Ireland. It exhibits the ornamentation and patterns which frequently occur on the English, Irish and Scotch crosses of the 11th and 12th centuries, and which may be traced to a Byzantine origin.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

Paris, February 28th.—M. Liouville in the chair. *A propos* of the researches of M. Trèves and M. Daniell, M. Secchi sent from Rome a note on the influence exercised by magnetism upon gases rendered luminous by means of electricity.

In order to study slight vibrations of the earth, an observer residing at Nice, M. Prost (?), has tried to see if the pendants of his chandelier were set in movement or not. He has discovered that their oscillations coincide with the eruptions of Mount Vesuvius, and the earthquakes in Africa, &c.

According to M. Perrin, there exists in the department of the Nièvre one of those blocks of stone which can be made to oscillate with very little force, and which are known under the name of "rocking-stones."

The death of M. Fournet, professor in the Faculty of Sciences of Lyons, has rendered vacant the post of correspondent in the section of mineralogy. The election for this post took place on this occasion, the number of voters being 49. M. Millevest was elected by 27 votes, against 18 given for M. Domeyko, 2 for Mr. Dana, 1 for M. Leymerie, and 1 for M. Maury.

[1] The paper is now in the press. It will be illustrated with four plates in chromo-lithograph, representing the different "eozoonal" structures originating from serpentine and other magnesian minerals that have undergone chemical or molecular changes. Figures are given showing the "nummuline layer" in true *cracks*; and another is added representing "chamber casts" covered with the same layer, in ophite from the *crystalline Liassic* limestone of Skye.

One of the most distinguished botanists of the Academy, M. Trecul, gave a lecture on the microscopic structure of the petiole of certain cryptogamia.

M. Lambert then read a paper on the experimental determination of the form of the earth. The process that he proposes consists simply in counting the number of oscillations made by a pendulum in a given time, and in reckoning the distance of the pendulum from the centre of the earth by means of a formula which he gives. The author asked the Academy to institute simultaneously experiments at the Observatory, at the bridge of Nôtre Dame, and on the top of the Pantheon.

The distinguished director of the Observatory of Moncaliéri, M. Denza, addressed, through M. Charles Sainte-Claire Deville, two papers relative to meteorology. The first relating to an Aurora borealis seen on the 3rd of January, offers the most striking confirmation of M. Silbermann's theory; the other recorded the fall of dust probably arising from the African desert, and which accompanied the fall of snow in Italy of the 13th and 14th of January. On this subject M. Deville pointed out the recent confirmation which his announcements have received relative to what he calls the *Saints de glaces de Fevrier*.

In the name of MM. Wolff and André, M. Delaunay gave a note on a bolide seen from the Terrace of the Observatory, on the 26th of February, towards 9 p.m. It was stated on this occasion that M. Delaunay would be appointed director of the Observatory.

Having submitted iron rust to analysis, Mr. Crace Calvert has found it to contain the following :—

Sesquioxide of iron	92·900
Protoxide of iron	6·177
Carbonate of iron	0·617
Carbonate of lime	0·295
Silica	0·121
Ammonia	traces
	100·000

NOTES AND MEMORANDA.

New Thermo-Electric Pile of MM. Mure and Clamond.—The thermo-electric pile is made up of sixty elements. They consist, says the *Engineer*, of small bars of lead, or native sulphuret of lead, and of plates of steel. The bars are 40mm. long by 8mm. thick, and the plates of steel are 55mm. long by 8mm. broad, and 0·6mm. thick. In these couples galena is the electro-negative element; iron, the electro-positive. The form of the bars is such that by placing them side by side they form a ring of twelve couples, of which the interior is formed by the extremities which are to be heated. They are united in tension by means of tin solder. They are isolated from one another by thin mica plates. By placing five of these rings in a vertical column a battery of sixty couples is formed. These rings are isolated and separated by washers of asbestos. The whole is firmly held between two iron rings by means of three bolts. The pile thus forms a hollow cylinder, the interior of which must be heated. The cooling of the junctions, whose temperature should be lower, is caused by radiation into the air. The interior cylinder measures 50mm. in diameter and about the same in height. The heated surface is about 78 square centimètres. The apparatus is heated by a gas-burner, consisting of a steel cylinder 56mm. in diameter, closed above, opened below, and pierced with small orifices. This is placed in the centre of the pile. A tube pierced with holes surrounds this cylinder and distributes the gas uniformly around it. The gas rises, and arriving at the orifices in the burner, meets the air which is escaping from it because of the draft of the tube of steel that surrounds the apparatus. Each orifice in the burner thus forms a blowpipe, the jet of which strikes the opposite side. Forty couples have an electromotive force equal to that of a Bunsen element. Its interior resistance to cold is that of a copper wire 9·85mm. and 1mm. in diameter. But during its action it increases and becomes equal to 22mm. The current is intense in proportion to the feebleness of resistance. Visible sparks are obtained between the two electrodes. The current reddens a platinum wire 0·3mm. in diameter a length of 35mm. It also decomposes water. This pile, acting for ten consecutive hours, consumed 785 litres of gas, at an expense of 2 centimes and a half an hour. It is, therefore, an economical generator of electricity.

Development of the Flowers of the Butterwort.—The Rev. M. J. Berkeley, F.R.S., contributes the following note to the *Gardeners' Chronicle*:—We have recently received a very interesting memoir by Professor Dickson on the development of the Flowers in Pinguicula, and the affinities of the natural order of Lentibulariaceæ. It is not easy to follow out the matter in dried specimens, but, after an attentive examination of the species contained in the Kew Herbarium, it appears to be pretty generally, if not universally, the case in the genus, that the flowers are produced from a winter or resting bud. This circumstance has been investigated with great care in the case of our commonest species. *Pinguicula vulgaris*, where we have just beyond the axillary bud of the last developed rudimentary leaf, two, and ultimately three, little elevated points, which are the first indications of the position of as many flowers. It would be interesting to learn in the case of those species which have more numerous flowers, whether they are all the creations of one or of several leaves. The little knob is soon slightly elevated, the elevation ultimately elongating into the leafless peduncle. The first indication of the formation of the flower is the development of a little ring at the top of the still very short peduncle. This ring soon exhibits five elevations, which are the rudiments of as many sepals; within this a second ring appears, the rudiment of the petals; then the two perfect stamens and staminodes, within which a horseshoe-shaped prominence appears, which gradually is developed into the two-lipped pistil, with the free central placenta studded with centrifugal ovules without the slightest appearance of any dissepiment. This latter character, notwithstanding a certain resemblance in the calyx, corolla, and bilobed capsule, seems to exclude the order from a very close affinity with Scrophulariaceæ, and to bring it near to Primulaceæ. Professor Dickson has studied the nature of the embryo in four of the species, and finds a minute character which seems to separate *P. grandiflora* from *P. vulgaris*, viz., that the base of the two cotyledons, which are united into one except at the very tip, incloses the plumule (punctum vegetationis). We cannot consider this as a single cotyledon any more than the two soldered cotyledons in Clintonia and some other cases. It would be interesting to follow out in a similar way the development of other plants which produce leafless peduncles from a swelling in the leaf, as, for example, in the one-flowered form of *Streptocarpus Rexii*, on the stem of which there are merely two minute bracts, as also the comparison of the large and small cotyledon in Streptocarpus with what Treviranus records in *Botanische Zeitung*, 1848, as to the germination of *Pinguicula vulgaris*.

Sleep-Disease.—The *Santé Publique* reports a case of a lady who, when eighteen years old, slept forty days continuously; and when twenty years of age, after being married, slept fifty days. During that period she remained motionless and insensible. She was in such a state of general contraction, that it was necessary to unscrew a pivot-tooth she wore, to introduce into the œsophagus a little beef-tea, her only aliment. Finally, four years afterwards, on Easter Sunday, 1862, she was found asleep in the morning, and never awoke until the next spring, in March, 1863. During that time animal life was null, organic life was good, but reduced to its minimum; pulse low, respiration almost insensible; no evacuations; the skin was fair, as well as the *embonpoint*, but complete insensibility and general contraction.

Wire-Rope Tramways.—It appears that the method of transport by wire-ropes which was tried on an experimental line near Leicester last year has made considerable progress since that time. Thirteen lines, varying from short distances to four miles in length, have been constructed, and upwards of 100 miles are in course of preparation or under contract. The French and Belgian patents have been purchased by MM. Cail & Co., the locomotive engineers, by whom they are being extensively worked, and a line of 60 miles is projected for the carriage of coffee in Ceylon, a five-mile section of which has just been placed on Brighton Downs.

Spectrum of the Fire-Fly.—The spectrum given by the light of the common Fire-fly of New Hampshire (*Photinus?*) is, according to the observations of Mr. C. A. Young, perfectly continuous, without trace of lines either bright or dark. It extends from a little above Fraunhofer's line C in the scarlet, to about F in the blue, gradually fading out at the extremities. It is noticeable that precisely this portion of the spectrum is composed of rays which, while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the Fire-fly is wasted. It is quite different with our artificial methods of illumination. In the case of an ordinary gaslight the best experiments show that not more than one or two per cent. of the radiant energy consists of *visible rays*; the rest is either invisible heat or actinism; that is to say over ninety-eight per cent. of the gas is wasted in producing rays that do not help in making objects visible.

A New Cab Register.—A new vehicle register, which has been invented by M. O. Vivier, a French chronometer-maker, and is intended says the *Builder* to put an end to overcharges by the drivers of hired vehicles, is described in the London *International* newspaper. The register occupies but a very small space; it may be fixed inside or outside the carriage. It has two distinct parts—one for the guidance of the proprietor of the cab, the other for that of the driver and the public. The part which is intended to guide the public consists of a couple of dials, always visible, one of which indicates the number of miles travelled, and the other the fractions or subdivisions of the last mile entered on. A spring can be pulled which instantly sends back the hands to zero. There is a self-acting arrangement by which, when

the carriage is empty, the register ceases to act. But would not such a register be apt to tempt cabmen to prefer long routes to short ones, for the purpose of increasing their fares?

SCIENTIFIC DIARY.

WEDNESDAY, March 9th.

Microscopical Society, 8 p.m. The following papers will be read by W. B. Carpenter, M.D., F.R.S., &c.:—"On the Comparative Steadiness of the Ross and Lister Models under trying circumstances." "On the Shell Structure of Fusulina." "On the Micropyle of the Fish's Ovum." "On the Reparation of the Spines of Echini."
Royal Literary Fund, 3 p.m.
Royal Society of Literature, 4.15 p.m.
Graphic Society, 8 p.m.
Society of Arts, 8 p.m. "On Tramways in Streets," by W. Bridges Adams, Esq. On this evening Charles Hutton Gregory, Esq., will preside.
Glasgow Philosophical Society, 8 p.m. "A Glance at some of the Vital and Social Statistics of Glasgow," by Mr. William West Watson, City Chamberlain.
Archæological Society, 8 p.m. "Curfew Bell of St. Albans," by Mr. J. Harris.
Geological Society, 8 p.m. "On the Structure of a Fern-stem from the Lower Eocene of Herne Bay, and on its Allies, recent and fossil," by W. Carruthers, Esq., F.L.S., F.G.S. "On the Oolites of Northamptonshire," by Samuel Sharp, Esq., F.G.S. "On the Geology of the district of Waipara River, New Zealand," by T. H. C. Hood, Esq., F.G.S.
Hunterian Society, 7.30 p.m. Council meeting. 8 p.m., "On some Unusual Cases of Stricture and their Treatment," by Mr. Reeves.
Epidemiological Society, 8 p.m. "On the Depopulation of the Vanni District, Ceylon," by Dr. Loos, communicated by the Colonial Office.
Belfast Natural History and Philosophical Society, and the Naturalists' Field Club, joint meeting, 8 p.m. "On the Iron Ores associated with the Basalts of the North-east of Ireland," contributed by Ralph Tate, A.L.S., F.G.S., and J. Sinclair Holden, M.D., F.G.S., and read by Dr. Holden.
Leamington Philosophical Society. "On the Ironclad Navy of England," by Mr. E. J. Reed, C.B., Chief Constructor of the Navy.

THURSDAY, 10th.

Royal Society, 8.30 p.m. "On some Elementary Principles in Animal Mechanics," No. III., by the Rev. S. Haughton, F.R.S. "On the Contact of Conics with Surfaces," by W. Spottiswoode, F.R.S. "On the Spotted Area of the Sun's Visible Disk from the Commencement of 1832 up to May, 1868," by W. De la Rue, F.R.S.; B. Stewart, F.R.S.; and B. Loewy. "Tables of the Numerical Values of the Sine-Integral, Cosine-Integral, and Exponential-Integral," by J. W. L. Glaisher.
London Institution, 7.30 p.m.
Society of Antiquaries, 8.30 p.m. "On a Roman Inscription in the Disney Collection," by Mr. H. C. Coote.
Zoological Society, 8.30 p.m. "Dinornis, Part XV." by Prof. Owen. "New Species of Ampullaria," by Dr. J. C. Cox. "Birds of Veragua," by Mr. O. Salvin. "New Birds from the Yantze-kiang," by Mr. R. Swinhoe.
Royal Society Club, 6 p.m.
Mathematical Society, 8 p.m.
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.

FRIDAY, 11th.

Astronomical Society, 8 p.m.
Royal Institution, 8 p.m. "On Art," by Prof. Westmacott.
Quekett Microscopical Club, 8 p.m.
Clinical Society, 8.30 p.m. "Cardiac Disturbance in connection with Nephritis," by Dr. Wilks. "Case of Atrophy of Brain, with great Depression of Temperature," by Dr. Greenhow. "Case of Inguinal Hydrocele," by Mr. Holthouse. "Cases of Amputation in which the Arteries have been Ligatured," by Mr. Callender.

SATURDAY, 12th.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. "Science of Religion," by Prof. Max Müller.

MONDAY, 14th.

Royal Geographical Society, 8.30 p.m.
Society of British Architects, 8 p.m.
Medical Society of London, 8 p.m.
London Institution, 4 p.m.
Glasgow Philosophical Society, Chemical Section, 8 p.m. "On Canadian Phosphate of Lime, and some other Mineral Phosphates now used in making Superphosphate of Lime," by W. K. Hutton, Esq. "On Plate Sulphate of Potash," by James Mahony, Esq.
National Association for the Promotion of Social Science, 8 p.m. "On the Real Estates' Intestacy Bill," by Joshua Williams, Esq., Q.C.

TUESDAY, 15th.

Statistical Society, 8 p.m. "On the Financial System of the Free Church of Scotland," by the Rev. Dr. Buchanan.
Institution of Civil Engineers, 8 p.m.
Pathological Society, 8 p.m.
Anthropological Society, 8 p.m. "On the Strange Peculiarities observed by a Religious Sect of Moscovites, called Scoptsis," by Dr. Kopernicky and Dr. Barnard Davis, F.R.S. "Phallic Worship," by Mr Hodder Westropp. "Consanguineous Marriages," by Mr. George C. Thompson.
Leeds Philosophical and Literary Society, 7.30 p.m. "On Sleep and Dreams," by Dr. Eddison.
Royal Institution, 3 p.m. "Nervous System," by Dr. Rolleston.

WEDNESDAY, 16th.

Meteorological Society, 7 p.m.
Society of Arts, 8 p.m. "On Surface Decoration," by William Pitman, Esq.
Philosophical Society of Glasgow, Sanitary Section, 8 p.m. The debate "On the Licensing System" will be read by Mr Thomas Dick, and brought to a close; Mr. Melvin being allowed half an hour to reply.

DR. TYNDALL ON DUST.—"G. S."—Thanks for your letter. We shall be glad to publish an account of the experiments. The publisher will communicate with you in reference to the missing letter.

TRANSIENT HEMIOPSIA. An erratum occurred in the letter on this subject in our last: the word *sang* should have been *rang*.

NEW ZEALAND HOT SPRINGS.—"A. R."—The photographs are most interesting. We could not possibly reproduce them. The letter, however, appears, and is important. We shall always be glad to publish similar communications.

LEAMINGTON PHILOSOPHICAL SOCIETY.—"M. B. O'C." Communication has reached us. Thanks.

THE PRESIDENT'S ADDRESS, GEOLOGICAL SOCIETY.—"W. K."—We are very sorry that we cannot comply with your desires. It is now too late. The communication you sent has reached us. We do not like to form an opinion on the subject of discipline *referred to* in your postscript.

"THE BOOK OF BIRDS."—Messrs. Cassell are thanked for their courteous communication.

SIR W. THOMSON *versus* GEOLOGY.—"P. W. S. M.'s" letter is to hand, too late, however, for the present number. The other communication shall be regarded of course as private.

THE VARYING CLIMATES OF GEOLOGICAL EPOCHS. "T. S. R." should read some good geological treatise. Say, Lyell's *Principles*. His letter is not suitable.

EDINBURGH BOTANICAL SOCIETY.—We should be obliged to the secretary if he would send us the reports earlier. The report now received is that of the meeting of the 13th of January, whilst we last week reported the subsequent meeting, having obtained it from another source. The report just sent us appeared in our pages about a month ago.

TERRACES IN NORWAY.—"M. H." must not blame us on this occasion. The proofs were sent on Monday, but were not returned in time. We had thought that when returned by the author they were in the former instances returned "for press."

NOTICES.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

Subscribers to SCIENTIFIC OPINION are informed that they can procure of the Publishers direct, or through their local Bookseller, neat cloth Cases for Binding Volumes I. and II. of this periodical, price 2s. each.

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WEDNESDAY, MARCH 16, 1870.

SCIENCE AND A REDUCED POSTAGE RATE.

We trust we shall not be accused of self-glorification if we attribute in some measure to our own efforts the steps which are now being taken to obtain a reduction in the postal rate of book parcels and newspapers. For we are certainly disposed to regard the movement made last week in this direction as the outcome of our remarks on this subject nearly twelve months since. Indeed, we may go further and say that we know that some of those who are now agitating the question were first led to consider the matter through an article which appeared in these pages nearly a year ago.

In SCIENTIFIC OPINION of April 7, 1869, we first called attention to the fact that the existing regulations pressed with undue heaviness on the Scientific world. We then made the following observations in explanation of the circumstance that our knowledge of Foreign Scientific work is generally very many months behindhand:—"Why, it will be asked, cannot the student of Science obtain the Continental journals at least a few days after publication? The answer is too plain. It is because he cannot pay the postage. The subscription is in many cases very small, but the postage is great. Indeed, in one or two instances the postage equals or exceeds the subscription to a weekly periodical. Thus the worker is forced either to give up the idea of keeping himself *au courant* of the researches of others, or else is compelled to wait till a publisher's parcel, with its irregularity, delays, and uncertainty in delivery, can be found to convey the required work. In the case of Scientific Societies the case is an especially hard one. These publish their own transactions, and in exchange for such they could obtain, free of all charge, the journals and periodicals of all the European and American academies and learned bodies. But St. Martin's-le-Grand stops the way; the postage would in itself alone be a tax which the resources of the Society could not possibly meet. Thus Scientific progress is retarded, while her Majesty's revenues are certainly not the gainer."

The words which we wrote in 1869 require no change in 1870, unless indeed it be an alteration which would give them more force and emphasis. Since then, we have made ourselves acquainted with the financial affairs of some of the less pecuniarily prosperous of our Scientific Societies, and we have learned that many of them are prevented from receiving the *Transactions* of kindred associations on the Continent by the very heavy postage which the exchange of such *Transactions* would involve. And what a serious detriment to Scientific progress is such a state of things as this! How much valuable time and labour are expended—how much money is often uselessly laid out by Englishmen—in carrying out inquiries which have already been completed on the Continent, but which are unknown here through the barrier which the existing postal regulations place in the way!

Holding, then, the same opinion which we so strongly expressed last April, it is with unfeigned pleasure that we note the Marquis of Hartington's reception of the deputation which waited on him last week to request a reduction in the rates for newspaper and book parcels. Without giving an unqualified assent to the views of the deputation, the Postmaster-General intimated as decidedly as so high a Government functionary could, that the Post-office authorities would give the matter consideration, and that all that could be done would be effected for the benefit of the public.

We have thus a promise of reform, which we do not doubt will ere long reach its fulfilment. But it may be asked, Did the deputation, which so ably expressed the wants of the general public, place before the Marquis of Hartington the requirements of Scientific Societies? That they did not must be patent to those who read the report of the interview. It was clear that in the statement made to the Postmaster the claims of Science were totally ignored, and that however desirous the members of the deputation may have been to aid the interests of all classes of the community, they forgot altogether the too-much-forgotten man of Science. But as the general principle of a reduction in the postage-rate for parcels has been recognized, and as the whole matter of change of tariff is still *in embryo*, there is yet time for Scientific men to induce the Government to grant them that small boon, of which, if withheld, we may say—

"It not enriches *them*, and leaves *us* poor indeed."

The grant of a reduced parcel postage would, no doubt, benefit Science while benefiting the whole nation. But the advantages to Science would not, after all, be very great if the scheme of reduction be such as the deputation demanded. We of the Scientific World want much more, and we believe that Government, by complying with the request of Scientific men, as has been done long ago in other European States, would essentially enrich the country, and would not entail on the postal conveyances any very serious excess of weight. What we should wish to see, then, would be not only a reduction in the postage on parcels generally, but also a free delivery granted to all the correspondence of Scientific Associations. This would not add much to the work already done by the mails, while it would diminish the expenditure of the funds of the different Societies, would induce them to communicate more regularly with the Continental bodies, and would thus most materially advance the ends of Science.

We do not doubt that if a deputation composed of representatives of the different metropolitan Scientific Societies was to wait upon the Marquis of Hartington and to explain to him the necessity for introducing some grant of this kind into any measure for the reduction of the postal tariff, they would find in the Postmaster-General one most willing to assist to his utmost in advancing the interests of Science. At all events, the experiment is well worth the trial.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

AMONG a number of grants for researches in Science made to scientific men in Ireland, the Royal Irish Academy has voted the sum of £25 to Professor W. King for the purpose of making investigations on the jointing, cleavage, and foliation of rocks. Some years ago Mr. King was led to conclude, with reference to the first two of these divisional structures, that rocks possessing them were, in the first instance, divided by jointings; and, in the next, compressed or squeezed by a force exerted more or less perpendicularly to the joint planes (see *Brit. Assoc. Report*, 1857, p. 76). It will be known to our readers that, following the late Daniel Sharpe, Mr. Sorby and Dr. Tyndall, each guided by independent observation, attribute rock cleavage to pressure alone. Professor King, however, contends that this agent by itself will produce nothing more than a schistose structure, incapable of yielding the large even surfaces of slate. In his opinion, any two surfaces belonging to a single cleavage division were originally the two planes of a joint, which have been so firmly united by pressure as to require mechanical force for their separation. Moreover, in *true* slate-rocks the compression has

been so intense as to bring into close contact the joints—even when removed from one another by considerable undivided interspaces, which may vary from less than an inch to several inches in width; thus producing their unlimited divisional structure. But slate-rocks, it is well known, are not always capable of being split to this extent, having often uncleavable compressed interspaces, forming thick or imperfect slates,—a peculiarity which is inexplicable on the generally received hypothesis. Interrupted cleavage singularly characterizes a rock occurring at Brathay, near Ambleside, which will only split along the joints into flags an inch or more in thickness. The Brathay rock has been compressed, as shown by its wrinkled deposition-surfaces, and the complete cementation of its joint planes; but the pressure was insufficient to bring the joints together. Professor King anticipates adding considerably to the data he has already collected, elucidating not only the above divisional structures, but the phenomenon of rock-foliation.

Professor Oliver commenced his course of lectures on Elementary Botany at South Kensington on Friday last. The attendance was a very large one, but the attention of the audience was not all that could be desired. Indeed, if we must speak the truth, it would be an advantage if some of the young ladies on the upper benches would avoid the "school-girlishness" which they display. Silence and careful attention to the lecturer are much to be desired. Their half-whispered gossip, *de omnibus rebus*, though not detected by the Professor, is extremely irritating to those ladies who really wish to learn botany.

The Quekett Microscopical Club appears to be a success which more than realizes the best hopes of its original projectors. It gave its annual *soirée* on Friday evening last, in the rooms of University College, and displayed a number of objects which were not only generally interesting to the scientific visitors, but in some measure marked the progress of the science of microscopy during the year. We observed, too, what we think a very excellent idea, that each visitor was furnished with a plan of the rooms in which the conversazione was held. By this means the guests were enabled without confusion to visit the particular departments in which they were interested, and were thus saved much time and trouble. The secretary and officers deserve considerable credit for the management of the entertainment. In connection with this society we may mention that at the next meeting, on the 25th, Mr. M. C. Cooke will read a paper on microscopic moulds, illustrated by diagrams and specimens. Mr. Cooke is, after Mr. Berkeley, our highest British authority on the subject, and we feel sure that those who hear this paper will learn many facts of interest and importance in connection with a subject which to physicians and microscopists is so fraught with problems of importance.

Some think that fungi have to do with the propagation of epidemic diseases, but be that as it may, we may mention that an affection which deserves to be studied in its fungological aspects—the foot-and-mouth disease—has made its appearance in several fresh places in North Staffordshire within the past few days. Its effects have been felt most severely on the west side of the Potteries, where there have been numerous outbreaks.

The official staff of the Mint has lately undergone so many serious changes that it does not surprise us to find that the Mint itself is soon to be transferred bodily to a new site. In answer to a question put by Mr. J. B. Smith, the other night, in the House of Commons, Mr. Lowe stated that, before long, the Mint would be removed from Tower-hill into the interior of London.

The *Melbourne Argus* gives us further accounts of the wonderful results of diamond-mining in Australia. We learn that about the middle of December another very fine lot of 121 diamonds, from the ground of the Mudgee Gold and Diamond Company, were received by the manager, Mr. W. H. Tuckett, through the Bank of Victoria. One beautiful stone weighed 2½ carats. In order to extend their operations, the company have purchased a steam-engine. Since the departure of last mail, the Australian Diamond Mines Company have been steadily pushing on their works, and have obtained with one machine 171 diamonds and 38 oz. of gold. The yield of gold has more than paid the working expenses during the month. The 171 diamonds will be sent to the company's agent in London by the outgoing mail. This parcel will make the total quantity sent to England 759 stones. Two of the company's machines have been idle, owing to the breakage of copper sieves; but they will be at work again in about a week's time. The six-carat diamond found in the Australian Diamond Company's ground, and sent to Europe to be cut, was returned to Melbourne by the last mail. It has been cut down to a diamond of $3\frac{3}{16}$ carats, and is an exquisite specimen of brilliancy and purity. It possesses an exceptional value as the first large-sized Australian gem discovered, and is highly praised by the lapidaries through whose hands it has passed.

On Thursday last a deputation waited on the Home Secretary to urge on him and the Government the necessity of passing an Act to amend the Medical Act of 1858. The deputation represented between nine and ten thousand members of the medical profession—in fact nearly one half of the faculty,—and was apparently very favourably received. We quite sympathize with the views of the deputation. Anything more clumsy, more inefficient, or less broad in its political principles than the Act of 1858 it would be difficult to conceive. It has cost the profession some hundred thousand pounds, it has taxed severely those who can least afford it, and has done nothing that could not have been effected at the cost of a few hundreds. It is not too much to say that the existing plan of medical education, while it is no guarantee to the public of the skill of a medical man, is a disgrace to the noblest craft among us, and a blot on the vaunted philosophy of the century. It is cumbrous without being comprehensive, and while unequalled in its severity, it is unsurpassed in the insecurity it offers to the public. It is a tree that has borne bad fruit. Let us lay the axe to its roots.

The tramway models on view at 35, Parliament-street deserve attention from all, whether students of mechanics or not, especially as we are soon to have the real tramways at work on our London streets. The line between Whitechapel and Bow will probably be the first finished. The car to be used is very similar to that seen in America—handsome, comfortable, roomy. It will convey twenty-eight outside passengers and twenty-two "insides," affording to all ample seat-space and opportunity of passage without the inconvenience which the ordinary means of conveyance, especially on a wet day, inflicts. The fare is fixed by Act of Parliament at a penny per mile, with an understanding that the charges may at any time be revised by the Board of Trade. Although the tramway carriage is narrower externally than an ordinary omnibus, it is 12 in. wider within, and very lofty. As one horse on a tramway is said to be equal to four on the road, the huge vehicle will be easily drawn by the customary pair. The promoters of the modern schemes have no doubt of their ability to avoid any hindrance or damage to the common street vehicles. The rails being level with the surface of the road, a carriage will be able to cross them without endangering its springs, as was the case with Train's ill-fated system, while the ¾-in. groove in which the flange of the car-wheel runs is too narrow to entrap the flimsiest wheel of the most elegant vehicle.

The last number of the *Journal of the Statistical Society of Ireland* contains some very valuable papers. Among them we may especially refer to those of Mr. W. J. Hancock, on the Laws of Massachusetts regulating the Business of Insurance Companies, and by Dr. Mapother, on "the Dublin Hospitals, their Grants and Governing Bodies."

Signor Miraglia, the well-known Italian professor, has just made a most curious gift to the Anatomical Museum of Naples. It consists of the skulls of ten criminals, a few of which had remained during more than sixty years stuck up on the walls of Castel Capuano, a monument of the barbarous ages. The professor has added to this gift an authentic history of the skulls, accompanied by various physiological and anatomical considerations on their appearance; and he purposes to adopt this as the subject-matter of a course of lectures which he will shortly deliver at Naples.

According to *Licht*, a German photographic journal, photography is being employed by the Prussian Government for the same purpose as in the War Department in this country; for the production, namely, of records of shot-and-shell practice against iron plates. A shield constructed by M. Gruson has, it is said, been destroyed by the effect of ten shots from a 96-pounder gun at 200 paces.

The Working Men's Club and Institute Union have, with permission of the authorities, arranged for a series of visits to the national museums on Saturday afternoons for the members of workmen's clubs. The important feature connected with these visits is that in each case the party will be under the guidance of some gentleman specially qualified to afford instruction in some particular branch of science and art. To enable the great majority of the visitors to these valuable national collections thus to learn something of the history and nature of the objects they see there is a real service to the cause of popular instruction. A party of fifty workmen were thus enabled to pay a visit to the Egyptian Department of the British Museum on Saturday, under the kind guidance of the distinguished scholar, Samuel Sharpe, Esq. We are requested to state that the "Club Union" will be very glad to have similar valuable services from other gentlemen for visits to the national collections.

At the usual monthly meeting of the Royal Botanic Society' held on Saturday, Mr. Charles Robert Turner in the chair, eight new fellows and members were elected by ballot, and the names of the following candidates were read:—Miss Emily J. Samuel, Mr. Robert T. Firebrace, Mr. James Burns, Mr. C. Crampton, Mr. Henry Cutler, Mrs. Farman, Mr. G. Sangster Green, Mr. Henry Brooks, Mr. Thomas Cope, Rear-Admiral Barnett, Sir George Brooke Middleton, Bart.

The Spring term of the Working Men's College commenced on Monday evening. Elementary and advanced classes were formed in arithmetic, algebra, geometry, book-keeping, English, French, German, Latin, and Greek grammar and literature, English history, the use of the microscope, astronomy, physiology, music, and drawing. To-morrow a general meeting will be held, when the principal, the Rev. Professor Maurice, M.A.; the vice-principal, the Rev. Professor Brewer, M.A., Mr. Thomas Hughes, Q.C., M.P., the Rev. Llewelyn Davies Bevan, LL.B., and other gentlemen will address the students. On Saturday next Mr. Nevil S. Maskelyne, M.A., Keeper of the Mineralogy Department of the British Museum, will deliver the first of a course of lectures on "Crystals."

The *Photographic News* has pleasure in announcing that the silver medal of the Bengal Photographic Society has just been awarded to Messrs. Robinson & Cherrill for "the best series of six landscapes or portraits taken and printed out of India."

Curiously enough, while the deputation referred to elsewhere is trying to induce Government to made a radical reform in medical education, a body called the *Medical Teachers' Association*, dissenting from the view of its first president, Mr. Simon, has been trying to bolster up the existing scheme by an infinite number of modifications of detail, which are gratifying to the small minds of some of the older pedagogues of the profession. We notice, however, that at the next meeting some matters are to be discussed which show that the young blood of the association is asserting itself. Among the agenda for the meeting on Friday, No. 3 is as follows:—"To consider the following, proposition of the Council in regard to schedules:—'That after the establishment of an efficient system of examinations, it would be expedient that the certificates of attendance on lectures required by the examining boards should be abolished.'"

In our leader on the Albert Hall of Arts and Sciences we pointed out the monstrous absurdity of pretending to advance Science by spending a lot of money in the purchase of a Brobdignag organ. We are glad to see that one of our musical contemporaries takes the same view from a purely scientific acoustic standpoint. It says:—"The largest organ in the world will be the organ now building by Willis for the Hall of Arts and Sciences, South Kensington; it will have 111 sounding stops, independent of 14 couplers—an absurd multiplication."

M. Ducos du Hauron continues his investigations in regard to the productions of colours in photography, and has written another note upon the subject, which the *Moniteur de la Photographie* reproduces *in extenso*. He has likewise forwarded further transparent specimens of his process.

The cost of material for the bronze coinage now in use is less than £100 a ton; the cost of the workmanship, by contract, is about £50 a ton, and the pence are issued or sold at the price of £448 a ton; showing a profit to the State of £330,000, or equal to about £10,000 annually.

A curious instance of the way in which exceptional cases lead to alteration of standing rules has been shown by the University of Aberdeen. In consequence of the difficulty which occurred in the case of a student who was registered at a late period of the Session, and whose vote turned the election for Lord-Rector, the University Court, on Tuesday last, unanimously agreed to the motion of Dr. Kilgour that all students, unless in special cases approved of by the University Court, must matriculate within three weeks of the commencement of the Session.

At the recent meeting in favour of the proposal to encourage women to adopt medicine as a profession, it was stated that some of the lady-practitioners had their hands full of work. Evil-disposed persons might think this the "puff oblique;" but "*Honi soit.*" We should welcome a thoroughly skilled female physician; but we should first like to see some really scientific women.

The Medico-Chirurgical Society of Bologna has awarded the Sgarzi Gaiani prize of 2,000 lire (£80) to Professor A. Corradi, of Pavia, for the best work on the improvements effected in surgery by Italians during the present century.

His Grace the Duke of Buccleuch, K.G., President of the Royal Horticultural Society, has nominated the following gentlemen for Vice-Presidents of the Society for the present year, viz.:—H.S.H. the Prince of Teck, the Lord Bishop of Winchester, Lieut.-Gen. Hon. C. Grey, W. Wilson Saunders, F.R.S.

The United States Government has recognized the danger of the so-called paraffin oils. A general order promulgated by the United States War Department provides that hereafter no volatile oils will be issued or used for illuminating purposes at military posts, and all varieties of coal-oil will be regarded as volatile. In general, lard-oil will be supplied for issues of oil authorized for the necessary illumination of military posts.

The President of the Botanical Society of France in his new dictionary has supported Mr. Darwin's views.

In our report of the Vienna Academy in this number it is stated that one of the chemical papers (on Feb. 3) was presented by Professor Redtenbacher. It is with much regret that we have to state that this eminent chemist is now no more.

A [illegible] of the higher mathematics is about to be instituted.

The Council of the Society of Arts, in concert with the Government, propose to appoint a commission to inquire into the existing condition of the trade in Guano, and determine if practicable the question of its analysis. It has decided to call a meeting conference at an early date to discuss the question of the "Relations of the Trade in Guano, and the Necessity for Official Inquiry into the Subject by Royal Commission." Col. Sykes, F.R.S., will open a discussion by reading a paper on the subject. Members and their friends are invited to attend.

There are already no fewer than fifty-three candidates for the three F.R.S. vacancies to be made in June.

We have to announce the death of two men of Science—the Rev. W. Cotton and Sigmund Cooper.

The Royal Agricultural Society is not satisfied with the proceedings of the Royal Veterinary College with reference to the enquiries into the diseases of cattle, sheep, and pigs. Out of the £500 annually given by the Society for the advancement of veterinary science in regard to farm stock, it was understood that £50 would be yearly devoted to experiments on disease. The Council of the Society are doubtful whether this has been sufficiently done, and therefore they now divide the grant into two portions. £300 is to be given for the general advancement of veterinary science, and the other £200 to be expended solely in carrying out such experiments in diseases as the Council shall require, the result to be immediately communicated to the Council, along with a detailed statement of how the £200 has been disposed of.

The Egyptian Government, in order to better protect ships entering Port Said for the Suez Canal, have just constructed a lighthouse at the entrance to the port. The new light is a flashing one, flashing every three seconds, and the illuminating apparatus is electric of the first class. The tower, which is built of wood and cement, is of a light grey colour.

It gives us great pleasure to be able to state that Herr von Graefe, whose ill health we referred to recently, has returned from Italy to Berlin, and has resumed his occupation, being now quite convalescent.

The subscription which has been raised in Paris with the object of affording assistance to the family of the illustrious Scandinavian naturalist, Bars, has been attended with unexpected success. In the space of a fortnight it has attained the sum of 6,000 francs—an amount which, says the *Lancet*, is quite unusual in France, even when the object of a subscription is most urgent and meritorious.

In regard to the proposed Horticultural Congress at Oxford, a correspondent of the *Gardeners' Chronicle* asks, Is it not possible to have the help of some of the college dons at a horticultural congress? Nearly all our great thinkers, from Bacon downwards, have been fond of gardening, and Flora's light and graceful garland has lightened up and gladdened many a brow oppressed with the magnitude of mighty thoughts. Could no professor or student bring back these great thinkers, and show in an informing paper their indebtedness to horticulture? A paper on Oxford horticultural worthies, or of great Oxford men who have found solace or pleasure at Flora's altars, would prove a graceful welcome to the Royal Horticultural Society. The sphere of the congress might also be enlarged to include botany, which is an important branch of education at the universities. And here Professor Lawson, the Professor of Botany, and others of the professors, could enrich the practicals with their learned lore. Again, gardening as a fine art would be a grand theme for the tongue or pen of a Ruskin.

We believe that all that has been said on the subject of London butter made from Thames mud is the wildest nonsense, but as the following statement of our contemporary, the *South London Press*, may excite a smile on the features of our chemical readers, we reproduce it:—"Another ray of light has been shed on the mystery of the conversion of Thames mud into butter. It seems that the banks of the river swarm with animal life—worms and so forth—and these are alleged to be the source of the chemical products added to the material supplied from the farms of England. In order, however, to set the question at rest, we have placed a specimen of the Thames mixture in the hands of an eminent analyst, and hope shortly to publish his report."

Professor Max Müller, in his recent lectures, has further developed his "Science of Religion."

A special exhibition of horticultural products will be given by the Imperial Central Horticultural Society of France on the 15th of May next. The exhibition will last six days, and will be held at the Palais de l'Industrie in the Champs Elysées.

Some correspondence has passed between Lord F. C. Cavendish, M.P., Chairman of the Committee for the Establishment of the "Yorkshire College of Science," and the Endowed Schools Commissioners. A rough outline of the scheme prepared for founding the College of Science for Yorkshire was submitted to the Commissioners, who were asked for their assistance and co-operation in regard to it, both by making the scholarships (which will probably be founded by the Commission) tenable at the proposed College, and also by their devoting to the endowments of professorships any funds that might appear to them applicable for the purpose. The Commissioners, in reply, express their cordial concurrence in the object in view, and their desire to do all they can towards its attainment. The object is one of the few which the Commissioners consider so important in themselves, and so likely to command extensive public support, as to lead them to think that it would be quite justifiable to attempt, in some cases, the partial diversion to them of the funds of endowments now solely applied to the traditional purposes of grammar-schools. The Commissioners observe that they have no power to create new endowments; but that it is within the powers conferred by the Act to direct the actual conversion of any existing endowments, single or aggregate, into an institution such as a technical college.

As an instance of the value of the microscope in various inquiries in which it might be thought of no service, we may cite the recent case of the Welsh fasting girl. At the last day's stage of the prosecution inquiry, Mr. John Phillips, surgeon, stated that he assisted the last witness to make the post-mortem examination, and corroborated his evidence. He found the right shoulder very much elevated, and the muscles more developed than the left. He lifted both arms, and found under the left arm-pit a hollow capable of containing a half-pint bottle. *He also examined with a microscope the contents of the stomach. He recognised starch globules in abundance, and several small pieces of bone—either of small fish or small birds. The starch was most probably taken from arrowroot.* John Daniel, uncle of the girl, deposed to having offered her water on the evening before her death. She turned away her head, and did not speak.

The new arrangements as to the proposed abolition of the Sandhurst Professorships are still under consideration.

A propos of the proposal to reduce the postage on parcels, Mr. Graves made the following motion in the House of Commons last night:—"That in the opinion of this House it is expedient to reduce the rate of inland postage on printed matter to one halfpenny for two ounces, and that the postage on newspapers should be likewise reduced to one halfpenny."

The *Lancet* has, in some measure, taken up the side of the students recently rusticated from the Queen's College, Galway. We hope soon to be able to go impartially into the whole of this matter. It is very difficult, amid such conflicting statements as those of the two sides, to come to any conclusion.

The late Mr. Thomas Smith, of Glassingall, who died lately at Avignon, has bequeathed £5,000 for building a museum, picture and sculpture gallery, and artisans' reading-room and library, in Stirling.

Livingstone's supplies have not yet reached him. The following letter from Sir Roderick Murchison will explain why:—"By a letter from Dr. Kirk, at Zanzibar, dated so late as the 7th of February, 1870, I regret to learn that an outbreak of cholera along the east coast of Africa, and extending for some distance into the interior, has for the present impeded the transmission of those supplies and porters to Dr. Livingstone which the Earl of Clarendon had directed to be sent to him. While the loss of life has been fearful at Zanzibar and on the coast north and south of it, and has also extended inland to Ugogo and Uniamezi, let us cherish the hope that the epidemic has not reached Ujiji on the Lake Tanganyika, where the great traveller has been for some time stationed. In this case, though the consummation of his labours is necessarily delayed, he may, I trust, under the protection of Providence, escape from this new and unexpected visitation, as he has from all the previous perils which he has successively encountered."

A NEW INSECT: *COCCUS FLOCCIFERUS.*

THE following remarks appear in the *Gardeners' Chronicle* from the pen of "I. O. W.":—

The various instincts exhibited by different species of animals, for the due protection and nourishment of their eggs and newly-hatched young, afford some of the most interesting peculiarities for the notice of the lover of Nature. These instincts are nowhere displayed under so many and such diversified forms as among the multitudinous tribes of insects. From the dragon-fly, which simply drops its eggs into the pond of water from which it has but recently emerged in the winged state, and in which its young as soon as hatched will be sure to find an ample supply of food, to the gnat, which glues them together and also deposits her eggs in water, but arranges them so as to form a little floating boat; or to the scarabæus, which incloses its egg in a mass of excrement which serves its young for food, and which it rolls into a perfect ball coated with sand and then buries beneath the surface of the ground; thence to the ichneumon, which bores through solid wood with its ovipositor, in order to deposit its eggs in the body of a living wood-boring larva, upon the fatty matter of which its young will feed; and onwards to the bee or wasp, which rear most wonderful structures for the reception of eggs and storing of food for the community, there is a successive development of mental activity, so to speak, which cannot fail to rivet our attention. Others, again, envelop their eggs in extraneous matters for their protection; thus a not uncommon species of British moth, which is remarkable for a large tuft of hair at the extremity of the body, forms a nest with these hairs, in the midst of which she deposits her eggs; whilst some of the species of Coccidæ actually develop, out of the pores of the exterior integument of their bodies, a waxen matter having a cottony appearance, which they employ in the same manner. This brings me to the subject of the present article. My attention was directed in the early part of last July to certain white objects upon the leaves and stem, and even upon the sticks used for support of the twigs, of a camellia. They were oblong, generally curved, about one-third of an inch long, and had all the appearance of the droppings of some small bird, one end being thickened and rounded. On examination I at once detected them to consist of the waxy, cotton-like secretion of a species of Coccus, of which I had previously met with no notice in works of economic entomology; and on carefully looking at the thickened end of the mass, I found the minute, shrivelled-up, and brown remains of a female scale insect. The elongated floccose mass was convex on its upper surface, having a slight depression running along the middle of the back, and also a fainter one along each side; it had also the appearance of transverse but curved impressions, so that it might almost be taken for the body of a footless caterpillar. On examining the tree more closely, I fortunately found a female individual still alive, and in the act of forming its floccose mass. The form of the female is broadly ovate and depressed, the head tolerably distinct, without any appearance of antennæ or legs visible from above. Having only found this single female in the act of forming its mass, I was unwilling to disturb it to examine the underside of its body, in order to see the structure of its legs, antennæ, and sucker. The hind part of the body is covered with minute particles of exudation, giving it the appearance of having been powdered with minute grains of moist sugar. The insect was of a pale greyish buff colour, the hinder part of the body having a slight fleshy tinge, and the lateral parts being freckled with fine dark lines meeting and forming cells. From the hind part of the body of the female was protruded a mass of the floccose white matter above mentioned, extending backwards about half the length of the insect, and exhibiting a few of the transverse compressed lines, evidently formed by the downward pressure of the extremity of the insect's body upon the soft waxy matter. Hence it is evident that the mass is gradually protruded backwards until it is three or four times larger than the whole body of the insect itself. On carefully examining the floccose mass with a microscope, an immense number of minute eggs were found imbedded in it, and which were hatched within a few weeks after my discovery of the animal. This event took place during my absence abroad, and on my return I found the bottom of the box in which I had placed the insect covered with minute powder, which proved to consist entirely of the dead bodies of the extremely minute young, which, having no means of escape, and wanting a due supply of food, had died. Although I had nowhere before seen this insect in any English conservatory, I detected it shortly afterwards on Camellias in the gardens of my friend Dr. Verboren, at Hooghtlands, near Utrecht, in Holland, where, however, it had not previously attracted attention. From the preceding remarks it will be evident that these beautiful trees ought to be carefully examined in the middle of the summer, at which time the parasite is especially visible, on account of its size and white colour, and the earlier the floccose mass is discovered and burnt the safer, as the eggs are deposited in the midst of the mass, and are hatched very shortly afterwards, the period of hatching, of course, depending on the heat of the weather at the time. We have still to speak of the early states of the insect, and its mode of attacking the Camellia, but in the mean time propose for it the name of *Coccus flocciferus*.

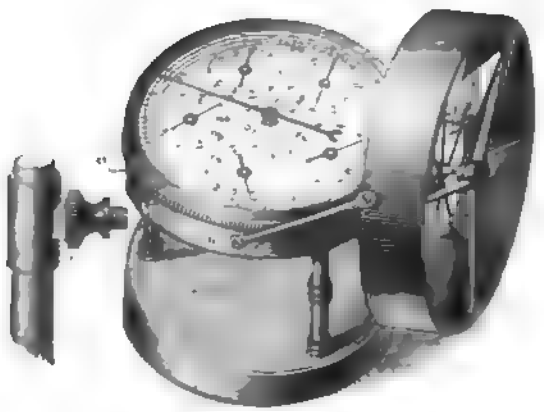
A CONVENIENT ANEMOMETER.

MR. CASELLA has introduced a very handy anemometer which has already received the approval of hygienic meteorologists and physicists. It is an instrument which might be employed with the greatest advantage in hospitals and other large buildings. Its object is to register the quantity of air which passes through the building, and as all real ventilation must be based on the estimate of this quantity, the apparatus is one having a thoroughly practical application.

It was first constructed for Dr. Parkes, F.R.S., of the Royal Victoria Hospital, Netley, for measuring the state of ventilation in that large military establishment, and declared to be the most perfect instrument of the kind in use. Since then it has been adopted in our Houses of Parliament, the United States Senate, several of our northern mines, and many of the leading prisons and hospitals throughout the country.

The graduations for each instrument are obtained by actual experiment by means of machinery made for the purpose, so that the indications of all are as comparable with each other as the weight or measure of ordinary substances.

The indications are shown by means of the large dial and hand, and five smaller ones, as shown in the annexed plate. The whole circumference of the large dial is divided into 100 parts, and represents the number of feet up to 100 traversed by the current of air. The five smaller dials are each divided into ten parts only, one revolution of each being equal to ten of the preceding dial, and representing 1,000, 10,000, 100,000, 1,000,000, and 10,000,000 respectively. By means of the large dial the low velocity of 50 ft. per minute is measured, and by the smaller ones continuous registration is extended up to 10,000,000 ft., or 1,893 miles, being practically beyond what the most extended observations can require, whilst jewelling in the most sensitive parts insures the utmost delicacy of action.



By moving the small catch *a* backwards or forwards, the work is put in or out of gear without affecting the action of the fans; this prevents the injurious effect of stopping them suddenly, and enables the observer to begin or end his observations to a second. A small handle with universal joint accompanies the instrument, and may be screwed in at the base; by putting a stick through this it may be raised or lowered to any required height and used in any position.

To use the air-meter, write down the position of all the hands. For this purpose place the instrument before you, with the 0 on the outer circle facing you. The first circle on the left hand indicates hundreds of feet, the next thousands, the third tens of thousands, the fourth hundreds of thousands, and the last circle to the right of the 0 marks millions. Begin to write down the position of the hands with the million circle, and then go round from right to left, always writing down the lowest of the two numbers if the hand is between two. Let us say that the hand on the million dial is at 0, the one hundred thousand between 2 and 3, the ten thousand between 7 and 8, the thousand between 1 and 2, the hundred at 5, and the large hand which marks units and tens at 73. The million hand would be omitted, as it has not reached 1, and the remaining numbers would run 271,573. The instrument is then put in the current to be measured, and when removed after a given time, is read in the same way; the first being deducted from second reading gives the velocity (uncorrected) in feet during the time. A simple table is provided, by means of which (in strict observations) allowance may be made for the difference caused by inertia at high and low velocities.

THE BRIMSTONE BUTTERFLY (*GONEPTERYX RHAMNI*).

BY R. LADDIMAN.

THIS common, but very delicate, butterfly is one which cannot fail to strike even the youngest beginner in entomology. Not long after this paper has met the eyes of the reader, the brimstone butterfly will be thinking of taking his "spring tour;" for no sooner has the sunny weather set in, than our "yellow friend" will wake up from his long winter's sleep, and wing his course madly through the "sweet primrose dells." 'Tis then the entomologist, who has been pent up for a long period amongst "bricks and mortar," and has doubtless spent a great part of his time in arranging his captures, &c., and making new resolutions for improvement (as the proprietors of the *Naturalist's Note-Book* have done, and, we are happy to find, have succeeded), may sally forth, net in hand, into the country lanes, or tread the wood or coppice, in search of the fascinating *Gonepteryx Rhamni*. But should he not meet with or capture a single butterfly, he may enjoy the charms of a pleasant ramble, revisiting, perhaps, some spot dear to his memory by some agreeable incident; and the health of an exhilarating walk is secured.

Doubtless, most of my readers are aware that this insect wherever it occurs, is one of the most common of our butterflies; but the male by far exceeds the female in abundance, and you may often take a dozen males of this butterfly, and, perhaps, not a single female will be seen. The flight of the brimstone is a very peculiar one, and has a great resemblance to that of the large white cabbage (*Pieris Brassicæ*); and should the entomologist not succeed in "bagging" him at the first strike, he must patiently wait for another chance, for he is almost safe to come back again after a few minutes, as he has a great habit of repeating the same journey for sometimes several hours.

The eggs of the Brimstone are laid in the month of April on the young shoots of the buckthorn (*Rhamnus catharticus*), and are, like the perfect insect, of a yellow colour. These hatch at the latter part of May or the beginning of June, and by the end of June or the early part of July, the caterpillars are full fed. The caterpillar is velvety, and of a pale green in colour, with a stripe of a whitish hue running along each side. Its shape is rounded above, and somewhat flatter underneath. When full fed it fastens itself by a silken belt round the middle to the stems of the buckthorn, and turns to a chrysalis of a delicate green colour, pointed at both head and tail, which after a short time changes to a dullish yellow.

The butterfly comes out early in August, and is so well known by all as to require no description. In order to see the Brimstone butterfly to the best advantage it is necessary to leave the busy hum and bustle of towns, and take up a position in a clover-field, for there the Brimstone loves to revel. In such a spot as this you may enjoy the luxury of scenting the sweet and delicious perfume of the clover, and perhaps, by way of a change, that of a pipe of the "fragrant weed," and feast your eyes on its golden glories. You will find no great difficulty in detecting our "yellow friend" as he wings his way over the purple carpet.

The individuals of this butterfly, observed in the spring, are the hybernated specimens. The Brimstone has been erroneously supposed by some to be double-brooded; but the juvenile entomologist must not be led into such a mistake as this. The "plumage" of those seen in the spring (in most cases) certainly looks quite as fresh as if they had not long emerged from the chrysalis, and not so "shabbily attired" as one might be led to suppose after a long winter's sleep.

The specimens appearing in early spring were said by some to be the offspring of those seen in the autumn, not thinking between October and April the buckthorn is destitute of leaves, and, consequently, there is no food for the caterpillars.

There is a well-known variety of the Brimstone butterfly which occurs in the south of Europe, India, &c., differing from the original type in having a suffusion of orange on the fore-wings. We are told this variety has been described as a different species under the name of Cleopatra; but the fact of it having been obtained from the same batch of eggs as Rhamni banishes all doubt.—*Naturalist's Note-Book.*

Botanical Specimens.—A. H. Curtiss, Liberty, Bedford Co., Virginia, has botanical specimens (catalogue furnished) for exchange for specimens of Minerals, Geology, Shells, and Insects.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From February 27th to March 12th, 1870.

[The following Table includes the returns for two weeks. Last week's list did not reach us till we had gone to press.—Ed. *S. O.*]

Name.	Country.	How obtained.	Where placed in Gardens.
1 Collared Fruit Bat (Cynonycterus collaris)	.....	Born in the Menagerie†	Monkey-house
2 Little Armadillos (Dasypus minutus) ♂ and ♀ ...	La Plata	Presented by C. D. Rowe, Esq.....	Sloth's and Anteater's House
1 Crested Guan (Penelope cristata)	Central America ...	Presented by Capt. J. L. Symon	Eastern Aviary
1 Spider	Ditto.....	Ditto.....	Superintendent's Office
2 Vulpine Phalangers (Phalangista vulpina) ♀	.....	Born in the Menagerie	Sloth's and Anteater's House
1 Feline Douroucauli (Nyctipithecus felinus) ♀	Brazil	Presented by Mr. C. Gilman	Monkey-house
3 Whydah Birds (Vidua paradisea) ♂	West Africa.....	Presented by Dr. Francis Wickstead ...	Western Aviary
1 Red-headed Cardinal (Paroaria larvata)	Brazil	Ditto.....	Ditto
1 Crested Agouti (Dasyprocta cristata)	South America.....	Purchased.....	Rodent-house
1 Bearded Lizard (Amphibolurus barbatus).....	Australia	Ditto.....	Reptile-house
1 Bonnet Monkey (Macacus radiatus) ♂	Continental India...	Presented by H. S. Carline, Esq.	Monkey-house
1 Grey Ichneumon (Herpestes griseus) ♂	India.....	Presented by W. Wiggins, Esq.	Small Mammal House
1 Hairy-nosed Wombat (Phascolomys latifrons) ♂ and ♀	Victoria, Australia	Purchased.....	Wombat-house
2 Swinhoe's Pheasants (Euplocamus Swinhoii)	Formosa	Deposited by J. J. Stone, Esq., F.Z.S. ...	Pheasantry
2 Silver Pheasants (Euplocamus nycthemerus) ♂ ...	China	Ditto.....	Ditto
1 Pallas's Eared Pheasant (Crossoptilon auritum)...	Northern China ...	Ditto.....	Ditto
1 Vulpine Phalanger (Phalangista vulpina)	Australia	Presented by Capt. Jas. N. Smart	Sloth's and Anteater's House
2 Senegal Touracons (Corythiax persa) ♂ and ♀ ...	West Africa.....	Purchased.....	Western Aviary
1 Rose-crested Cockatoo (Cacatua moluccensis)	Moluccas	Presented by Arthur Lewis, Esq.	Parrot-house
1 Marimonda Spider-monkey (Ateles belzebuth).....	Guiana	Purchased.....	Monkey-house
4 Triangular Spotted Pigeons (Columba guinea).....	West Africa	Ditto.....	Western Aviary
6 Weaver Birds	Africa	Ditto.....	Parrot-house
1 Macaque Monkey (Macacus cynomolgus) ♂	India.....	Deposited by Mrs. Brownlow	Monkey-house
1 Great Kangaroo (Macropus giganteus) ♀	.....	Born in the Menagerie	Kangaroo-sheds
1 Rabbit-eared Perameles (Perameles lagotis).....	West Australia ...	Presented by Dr. F. von Mueller, C.M.Z.S.	Sloth's and Anteaters'
1 Blossom-headed Parrakeet (Palæornis bengalensis)	Hindostan	Deposited by Lieut.-Col. Seymour, F.Z.S.	Parrot-house [House
1 Ring-necked Parrakeet (Palæornis torquata)	India.....	Ditto.....	Ditto
3 Angora Cats (Felis domestica, var. Angorensis) ...	Ditto.....	Ditto.....	Small Mammal-house
1 Tawny Eagle (Aquila nœvioides)	Cape Colony.....	Presented by E. L. Layard, Esq., F.Z.S.	Eagle Aviary
3 Plumbeous Finches (Spermophila plumbea).....	Brazil	Purchased.....	Parrot-house
1 Sclater's Impeyan (Lophophorus Sclateri) ♂ * ...	Upper Assam	Presented by Major Montagu, Bengal Staff Corps	Winter Aviary
1 Blyth's Tragopan (Ceriornis Blythii) ♂ *	Ditto.....	Ditto.....	Ditto

♂ Male. ♀ Female. * Never previously exhibited. † First time of having bred in the Society's Gardens.

FEEDING TROUT IN FISH-PONDS.

FROM the third *Report* of the Commissioner of Fisheries of the State of Maine, U.S., we extract the following in reference to food for trout:—

Rearing fish in small, private ponds, where they must be altogether fed by hand, will answer very well when confined to the maintenance of the young through the early stages of growth, when they would be most liable to destruction if turned loose, or to the growing of a limited number of breeding trout or fresh-water salmon. But when it comes to raising fish for the table, such management does not promise to produce cheap food for man, unless there be found some source of food for the fishes that shall be cheaper than any that has yet been proved. It may be as easy to raise trout as to raise chickens or pigs; but in order to furnish them as cheaply to the market, they must be grown on food as cheap as that which grows chickens and pigs. Now trout are carnivorous—so are all other fishes with whose habits we are acquainted. To be sure, many kinds will eat vegetable substances—bread, corn, rice, and so on, and it is quite probable that these matters contribute to their nourishment; but whether there be any species that is mainly a vegetarian is a matter of doubt. Even gold-fish are found to grow sickly if deprived for a long time of animal food. But animal food is expensive, at least that which is to be had in the markets; and as to butcher's refuse, the necessity of obtaining during warm weather a fresh supply almost daily would greatly increase the expense. Besides, a tolerable approach to economy in the use of meats, which is sure to take place with the increase of population, and the consequent demand would so far utilize many parts of slaughtered animals that now go to waste, that the residue would hardly be equal to any great demand from fish growers. The food that has generally been used for trout is liver. Some calculations regarding the profitableness of raising trout have been based on the supposition that liver can be obtained at three or four cents a pound, and at this price it may be that trout can be reared and marketed at a profit, but they certainly would not be *cheap*, and probably would be only luxuries. Yet parties engaged in trout-growing in Massachusetts have been paying, during the past season, for ox-liver, to feed their young fry, *ten cents a pound*, a price which, if the liver were fed to the larger fish, "would be ruinous." Curdled milk has been used by some with favourable results; and should this be found, on full trial, to meet all the wants of the fish, it must take the place of liver and such meats. One company, located at West Barnstable, Massachusetts, feeds the large trout on salt-water shrimps, gathered in the marshes in the immediate vicinity, and costing one dollar per bushel. Should all these plans fail, it is yet believed that some way will be discovered of utilizing the insects that devour our crops, or the flies that breed in offal and about stables and manure heaps.

A bare statement of the number of persons engaged in this industry will show that it is no longer regarded in the light of an experiment. In New England and the Middle States there are probably thirty or forty establishments for the cultivation of fish, principally trout, with a view to profit. One firm in Western New York hatches several hundred thousand trout annually, and has realized as much as $10,000 profit in a single year. These profits, however, be it borne in mind, are mainly from the sale of young fish and fecundated eggs.

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THE MECHANICAL CONSTRUCTION OF SHIPS' LOGS.

BY VAUGHAN PENDRED, C.E.

IN order to estimate the true velocity of a ship, due, say, to a certain power of engines, we must regard the water as being absolutely at rest with regard to her; for it is obvious that if the water in which she is partially immersed has a proper motion of its own, that motion will affect the absolute velocity of the ship through space, accelerating or retarding her according as the motion of the water is with her or against her. Thus, a vessel going on the measured mile with a tide of three knots an hour under her will have an absolute speed three knots an hour faster than her true still-water speed when running with the tide, and three knots an hour less than her true still-water speed when running against it. In order to eliminate this factor, ships on the measured mile run three times up and three times down the mile. The average velocity of all six runs, found by the mean of means, is then taken to represent her true speed, it being assumed that she will be as much accelerated during three of the runs as she is retarded through the other three. But this assumption is not necessarily well founded, because it is possible so to arrange the time of taking the runs with regard to the tide, that only two of the runs out of the six shall be against the tide, three of the runs with it, and one at slack water, or even on the turn. By this means the velocity of a ship can be made to appear greater than it really is. Honestly conducted, however, the measured-mile trial constitutes the only means now used in her Majesty's navy of ascertaining the true speed of a ship, and this is one of the two methods referred to as exact in the beginning of this paper. Measured-mile trials, however, are full of defects, well known, and resulting in the fact that the speed of a ship on the measured mile is always apparently greater than her speed at sea.

Of late years the system of six hours' trial has been introduced. A ship runs down Channel for three hours, and then back again to her port of departure, say Portsmouth, for three hours. The distance run in the time is regarded as deciding her speed. But, in the first place, unless much care is taken it is quite possible to have a strong tide telling either against or for the ship the whole time; and, in the second, no accurate means of remarking the distance run exists. It is, of course, easy to say that from point to point (taking landmarks as a basis) the distance is by chart so much; but a bad steersman, or the influence of the wind or sea, may cause a ship to go over much more water than that indicated by the position of landmarks on the chart; for if the ship took a sinuous course it is obvious that her true speed could only be ascertained by measuring the circumferential length of the curves traversed. But the chart assumes that the ship traversed only the chords of these curves; very frequently, as a consequence, the distance is measured by the number of revolutions made by the screw; slip being deduced from the measured-mile trial. Nothing can be less scientific. The six hours' trial-trip system is, therefore, eminently unsatisfactory, and it remains a fact that no means of measuring the absolute velocity of a ship with minute accuracy is now in general use.

But it is not during trial trips alone, or even principally, that it is expedient to know the exact speed at which a ship is moving from point to point of the earth's surface. To the practical navigator the means of obtaining a good general idea at least of the speed at which he is sailing or steaming are absolute necessities. The author is not about to take up the time of this meeting by any dissertation on the science of navigation. He will proceed at once to assume that the existence of a speed-measurer on board every ship is recognized as essential to proper navigation, and go on to describe such apparatus for measuring the velocity of ships as appear to deserve attention.

The apparatus in most general use for this purpose is the common log. This is made of wood, in the form of a sector of a circle, loaded with lead at its circumference, so that if left to itself it swims upright in the water with the apex at the surface. The log is usually 5 in. or 6 in. long and ¼ in. thick. It is attached to the log line by two cords, one of which is fixed at the apex of the sector permanently; the other passes through a hole near the circumference, and precisely in the middle of the width of the log. It is secured by a wooden peg in such a way that when the log is exposed to the strain of hauling in, the peg comes out, the lower part of the log is released, and it floats flat, or nearly so, on the water, offering little resistance to being hauled on board. The line attached to the log is marked at certain equal distances with knots, which are again subdivided into tenths, called fathoms. It is wound on a reel, and when we wish to find the ship's rate the log is thrown overboard, and a quantity of line allowed to run off the reel, that the log may float clear of the ship's wake. This part of the line is called stray line. It varies in length from ten to twenty fathoms, and is marked with a piece of white bunting. When the bunting passes over the quarter the officer calls out "Turn." A half-minute glass is then turned, and directly the glass is run out the assistant calls out "Stop." The line is then checked, and the pull of the water on the log causes the peg before noticed to come out, and the log lying flat on the water is hauled in. The operation is called heaving the log. The log glass runs out—in theory—in half a minute, or the 1-120th part of an hour, and if the divisions between the knots be the 1-120th part of a nautical mile, it is apparent that if one division be drawn out the speed of the ship is a mile an hour; if two, then her speed is two miles an hour, and so on. For each knot passed overboard in half a minute the ship is going one nautical mile an hour, and this is the origin of the word "knot," as will be easily seen. The length of a knot is found thus:—Circumference of earth = 360° = 360 × 60 nautical miles = 21,600. In practice the *length of the nautical* mile is usually taken as 6,080 ft. The distance between the knots should be 50 ft. 7⅜ in.; it is really 47 ft., to compensate for errors due to the log coming home.

It is difficult to conceive a more rude method of measurement than that just described. The rate at which the sand runs through the glass is affected not only by the weather, but by the motion of the ship. The length of the line is affected by its repeated immersions; and last, but not least, the hold of the log on the water at slow speed is so small, that unless the line is payed out by hand an error of a knot or two an hour may be easily caused by the mere friction of the reel, however carefully that is mounted. As a result, we find in every treatise on navigation a special warning to the student not to depend absolutely on the log, and formularized directions as to the means of eliminating such errors as can be got rid of. The author cannot do better here than refer such of his hearers as wish to investigate this matter further to Merrifield & Evers' very able treatise on *Navigation and Nautical Astronomy* published by Longmans in 1868.

The first mention of any form of log with which the author is familiar occurs in an account of an East India voyage by Purchas, dated 1607. Gunter described the log in 1623, and it is noticed in all succeeding works on navigation. From 1623 to the present day the common log has scarcely undergone any modification. Its defects, however, became apparent very early, and numerous attempts were made, not to improve it—a hopeless task—but to invent something better.

Very far back, indeed, in the history of scientific discovery we find evidence that it was known that a fluid current impinging on inclined vanes would cause rotation. No one knows who invented the windmill, for example: it is prehistoric in a sense. It was also discovered that by moving vanes inclined to their axes through a body of fluid at rest, rotation would be set up in the vanes by the creation of an artificial current, and it was also understood that the velocity of rotation might be made to bear a fixed relation to the velocity of the current on

the one hand, or the velocity with which the vanes were drawn through the resisting medium on the other. Here, then, was the germ of an idea for a log. Attach a screw to a rod, and allow it to tow behind a ship in such a way that one end of the rod could—impelled by the screw—rotate inboard, then, assuming the number of turns made by the screw in a minute to bear a definite relation to the velocity of forward progression of the ship, nothing was easier than to design a counter, which, attached to the rotating rod, would show from time to time on a dial figures from which the speed of the ship could be calculated. This is the principle which has been involved in a number of inventions too large to particularize. Patents for improvements in logs were taken out anterior to the year 1703; but as no descriptions are filed with the patents, it is impossible to say in what the patent consisted. In the *Philosophical Transactions* for 1725, however, Mr. Henry de Saumerez describes machinery for measuring ships' way better than the common log. This consisted of a Y-piece capable of rotating on the straight tail of the Y, the arms of which were each fitted with a vane or screw blade. The Y was fixed to a rope and towed astern. The rope was caused to rotate by the action of the water on the vanes, and, to use Smeaton's words in describing the apparatus, "the value of a certain number of turns once found by experiment, they are easily reducible into leagues. &c. The only difficulty is, Will the same number of turns be always made in passing through the same distance?" Smeaton commenced experimenting with this apparatus in May, 1751, on the Serpentine. The results of his experiments led him to the conclusion that the velocity with which the ship moved forward made no material difference in the velocity of rotation—or, at least, that the difference would be less than that arising from other causes. The first log was too big—being 27 in. long, and the vanes 8 in. long by 4 in. wide. Smeaton then constructed an improved log, consisting of a plate of thin sheet brass, oval, 2½ in. wide and 10 in. long and delicately mounted on a spindle only one-twentieth of an inch in diameter, rotating in agate holes. Very ingenious arrangements were introduced to save this delicate apparatus from being broken, on which it is not necessary to dwell. With this apparatus a great number of experiments were made at the Nore, from which it became apparent that the slower the speed of the ship the greater were the number of revolutions made by the log—exactly the reverse of what might have been expected. As an instance of the extreme irregularity of the results, one experiment may be cited in which the speed of the vessel or sailing ship was measured both by the common log and the screw log; 375 yards of log line were run out in periods varying from 45 seconds to 135 seconds, the velocity of the screw on the same occasions being 62 to 83. Here we have 62 turns made in 45 seconds, and 83 turns in 135 seconds. Two screw logs however, tested over a long time together gave, one, 86,716 revolutions, while the other made 88,184 revolutions. On the whole Smeaton concluded that at moderate speed it was possible to use a screw to register the velocity of a ship with some approach to accuracy.

In 1792 Gower patented a screw log, and several others followed his lead up to the year 1834, when Mr. Massey patented his well-known log, modifications of which are in considerable favour now, especially in America, under the general title of Massey's Patent Log. In 1836 he secured another patent, a third in 1844, and a fourth in 1848. As Massey's is one of the few screw logs which have competed successfully with the ordinary log, it may be well to describe it at some length. On the table will be found a Massey log of the modern pattern, which will far more clearly explain its construction than any diagram. It consists of two portions—the rotator and the register. The first consists of a short length of light brass tube, to which spiral vanes are soldered. This rotator will nearly float in water owing to the lightness of the central tube. The register is simply a triangular box fitted with vanes to prevent rotation. It contains a train of simple wheelwork, and a set of dials on which the number of revolutions made by the rotator are recorded, in terms of knots and units of knots. The gear is so simple that it requires no description. An endless screw sets the train in motion, the screw being itself connected with the rotator by a short length of Manilla rope. In using this log the hands are set at zero, and the log hove overboard, attached to a line ten or twenty fathoms long. The time of heaving is noted; at the end of a certain number of minutes or hours, the log is hauled on board, and the number of knots run since it was heaved noted. The result divided by the time gives the speed. This log is very different in many ways from those originally patented by Massey. In his first arrangement the log was anchored to the heel of the stern-post; it consisted simply of a rotator driving a recording apparatus, placed inboard, by a set of turned rods. In a subsequent patent he claimed the use of electricity for registering inboard the rotations of a log floating astern. Nothing would be gained by describing at length arrangements which never came into actual use.

Another very neat speed-measuring apparatus is that known as Walker's harpoon log. One of these is seen on p. 267. Its characteristics will be taken in at a glance—it is Massey's log in a compact form, the recording arrangements being nearly the same. This much resembles Massey's frictionless log. In Friend's log, also on the table, a paddle-wheel is used to drive the recording apparatus instead of a screw. Other forms of screw log have been patented, but it would be mere waste of time to describe them, as they are all identical in principle.

It will be seen that the value of any screw log must depend on the uniformity with which a given number of revolutions are made in running a given distance, say one knot, at all speeds likely to be attained by a ship, and under all conditions of weather. Tested by this rule the screw log is found wanting. In the first place, the number of revolutions made in traversing a given length of water will depend on the resistance of the recording gear, and the angle at which the vanes are set—in other words, on the pitch; besides this, variations in the depth of immersion will affect the rate of rotation. Now, it is simply impossible that the gearing, light and small as it is, should always remain in perfect order, and a little neglect in the lubrication will materially increase the resistance. Again, a careful examination of the log on the table will show that very little rough usage will suffice to bend and distort the vanes, and render the instruments quite unreliable. They are, indeed, delicate pieces of apparatus, and require careful handling; but apart from these considerations, a grand defect lies at the root of the principle of these screw logs. It has never yet been proved that precisely the same number of revolutions will be made in running a given distance at all speeds. Far from this being the case, Smeaton's experiments already quoted proved the contrary. At very high speed and in rough weather he noticed that the log he used was constantly dragged out of the water, flying from one wave to another across the hollows. Upon the whole there is reason to believe that a screw log is capable of approximately measuring the speed of ships, and the slower the speed and the smoother the water the more reliable will be its indications; but it must not be forgotten that at velocities of less than three knots an hour the indications of the screw log are totally unreliable. It is no wonder, then, that the common log remains in favour with all shipowners, and that the use of the screw log is to a great extent exceptional.

It is further to be noticed that the screw log will not show immediately what the speed of the ship is; both that and the common log measure the velocity of the ship by the time taken to traverse a given distance, and time must, therefore, elapse between the heaving of the log and its reading before the rate of speed can be calculated. In yacht races this is very objectionable, and it is at all times more or less inconvenient. A log which would show at a glance and instantaneously, not only the actual speed, but every variation in the speed of the ship, with absolute accuracy at all speeds, would obviously

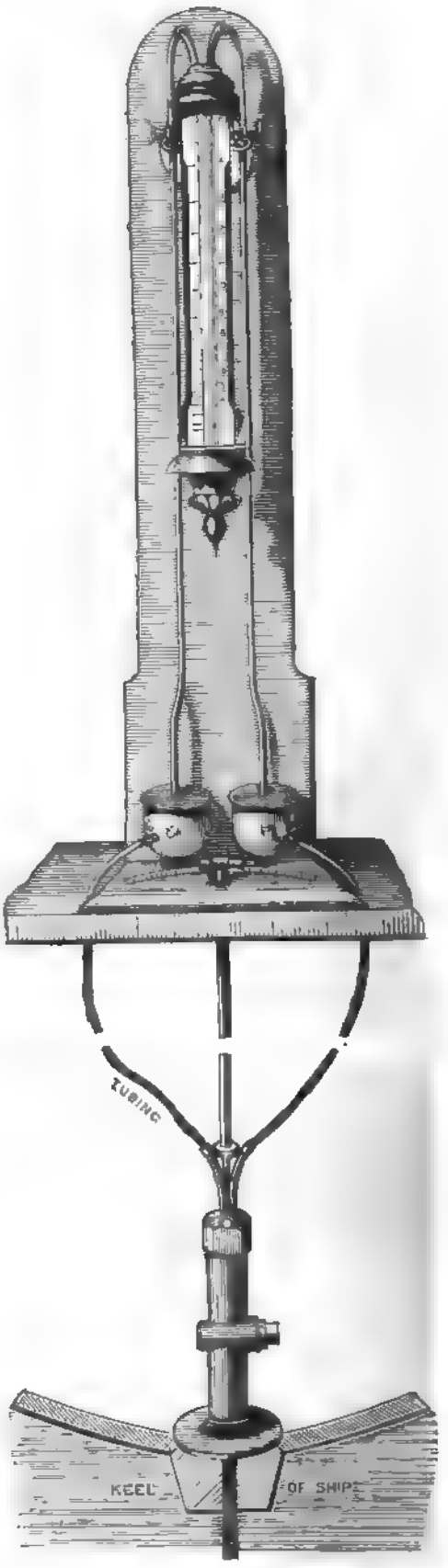
possess important advantages over all others. With the common and screw log we must first measure a given distance run before we can determine the speed. In fact, they are not speed-measurers but distance-measurers; and they are more or less imperfect measurers of distance. What is really wanted is not a distance-measurer, but a speed-measurer. In using the former we first ascertain the distance run and then speed; by using the latter, we first ascertain the speed and then the distance run. It may be asserted that these things are identical; but the author submits that they are totally different. In the first place, all the distance-measurers in use are inaccurate, but a speed-measurer may be made which shall be absolutely accurate; and, in the second place, no distance-measurer can tell in a moment what is the effect of setting or taking in a particular sail, or of trimming a ship in a particular way; but a speed-measurer will tell both or either, the moment the sail is set or the trim altered.

It now becomes the author's duty to describe apparatus by which speed may be measured without regard to distance run; and in so doing it is his good fortune to call the attention of the society to one of the most beautiful contrivances ever produced,—to one of the most exquisite applications of a recondite law of nature to a practical purpose ever effected,—to an invention which has successfully borne the test of over twenty years' hard service,—to a natural phenomenon regarding the induced current, and to a yet unnoticed law of the action of that current that can hardly fail to prove eminently interesting. Before describing this apparatus it will be necessary to call attention to one or two facts connected with fluid pressure.

When a ship is advancing through the water it is evident that her bows are exposed to a greater pressure, due to the resistance of the water, than her stern. If, then, a pipe, say ½ in. in diameter, were fitted in her hull, in such a way that one end opened in the cut-water below the water-line, while the other was turned up towards the deck above the water-line, it is obvious that as she advanced through the sea the water contained in the horizontal portion of the pipe would be driven inwards, and would rise in the vertical leg above the level of the water-line till it balanced by the gravity of the vertical column the outer pressure. It is also clear that the pressure would depend on and vary with the rate of progression of the ship, and that, as a consequence, the speed of the ship at any moment would be denoted by the height of the column in the vertical leg of the tube. This constitutes "Peto's tube." Here, then, to all appearance, we have a perfect continuous log. One individual, whose name the author forgets, was, indeed, so delighted with the idea that he patented a log consisting of a small pipe laid along the keel, opening in the cut-water with a trumpet mouth, and running aft to beneath the captain's cabin, into which it rose and indicated in a glass tube fixed against the bulkhead. A very little consideration will show that this apparatus was absolutely worthless. In the first place, at considerable velocities, the column of water in the cabin would stand some 12 ft. higher than the level of the sea; and no cabins will admit of a gauge being used the range in which is anything like 12 ft. But, apart from this, the water in the tube, owing to the position of the latter, is exposed to the influence of heavy seas striking the ship's bows with a force quite competent to send the water up double 12 ft. high; and, in the second place, as the height of the column in the vertical leg would be influenced by the draught of water of the ship, the indications of the gauge would vary from day to day and from hour to hour, especially in steamers, whose draught decreases as the coals are consumed.

On the 20th of December, 1849, the Rev. Edward Lyon Berthon patented an application of this principle, and in June of the year following a second improvement on it, which supplied the naval world with an apparatus absolutely perfect in theory and practice for measuring the speed of ships.

This apparatus consists essentially of a small tube, called a "way" tube, passed through the keel of the ship at or about



Berthon's Perpetual Log.

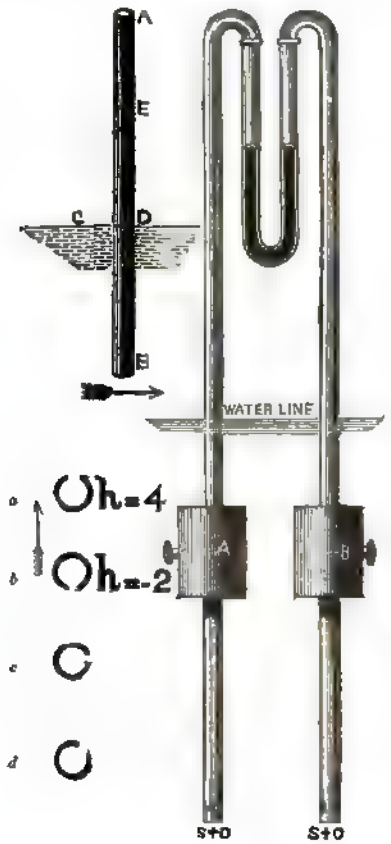
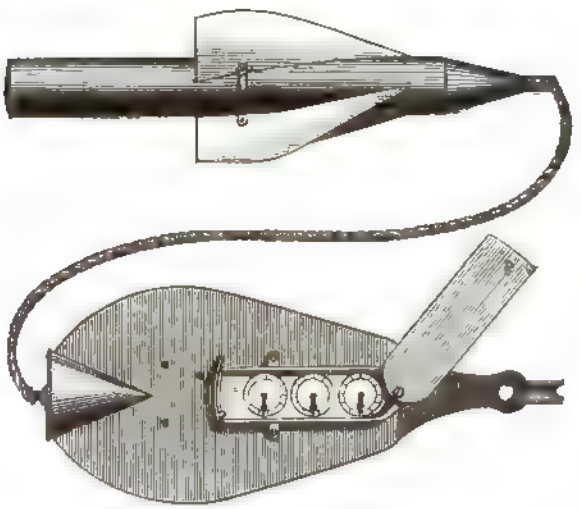


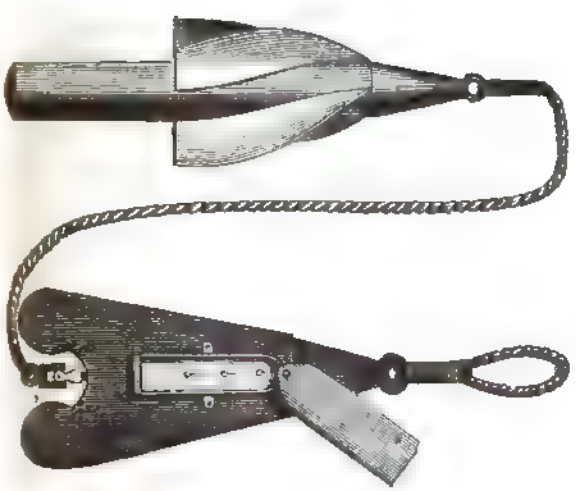
Diagram of Berthon's Log.



Massey's Improved Log.

Massey's Frictionless Log.

Walker's Harpoon Log.



Massey's Log.

Friend's Log.

amidships. At a distance of a few inches from the keel a small aperture is made in one side of this tube. The tube is carried up into the captain's cabin, or any other convenient place. There it is turned over and united to one leg of a siphon tube inverted, and containing mercury. A motion of about 13½ in. in the column of water will cause a motion of about 1 in. in the column of mercury, and the magnitude of the gauge range is thus brought within reasonable limits. When the ship goes ahead the water forces its way into the tube and affects the gauge, marking the speed of the ship as before explained; and this arrangement has these two advantages over the first described—that the gauge is brought down to a reasonable length, and that the waves do not interfere with its action; but it is still open to the defect that it is affected by the draught of water and the rolling of the ship.

The foregoing description conveys nothing more than a popular idea of Berthon's log in the crudest form.

In this shape it was fitted to a fast Channel steamer, and made the subject of a vast number of experiments. Let us see with what result.

The first thing to be done was to eliminate the influence of the ship's draught. Now it occurred to Mr. Berthon that if, the aperture in the pipe being turned ahead, pressure was exerted on the column of water within, which made it rise, by turning the aperture astern there would be a negative pressure, and the column would fall. Then between these two positions must lie some negative position in which the column would neither rise nor fall. If, then, the "way" pipe was so fitted that it could rotate on its axis, by turning it till the side aperture was in the neutral position the precise draught of the ship would be shown inside. The index or scale could be set to this, and then on the pipe being re-turned to bring the side aperture ahead, a correct reading would be at once obtained of the speed of ship. Mr. Berthon very naturally concluded that the neutral position would be that in which the aperture was turned exactly at right angles to the keel of the ship. How far this was verified by experiments we shall see presently.

Before going further it will be necessary to investigate the mathematical principles which regulate the ascent of the water in the tube.

Let A B in the diagram represent a tube, open at the top and closed below, with an aperture at B, near the lower end, and plunged into a fluid of which the surface is C D. When at rest the fluid, disregarding capillary attraction, will stand at the same height, C D, within the tube. But if the tube be moved forward in the direction of the arrow the fluid will rise to the height E, so that the column E C D becomes the measure of the velocity. Let h be this column. Then, taking the value of h from the well-known formulæ, $V = \sqrt{2gh}$, and $h = \frac{V^2}{2g}$; and in practice this law is found to apply with strict accuracy. Done into a simple rule, the height of the column of water in the tube above the level of the fluid in which its lower end is immersed will always equal the square of the velocity of the ship in feet per second divided by 64. Thus, let us suppose that a vessel is moving at the rate of 16 ft. in a second, or nearly ten knots an hour, we find that the column would stand 4 ft. above the level of the sea outside the ship, for $16 \times 16 \div 64 = 4$. If the ship move at twice this velocity the column would have a height of 16 ft., for $32 \times 32 \div 64 = 16$. In the same way, by multiplying the height of the column by 64, and extracting the square root of the product, we get the speed. The author feels that he almost owes his hearers an apology for putting such well-known formulæ into words. His excuse is that it serves to impress facts on the memory which are otherwise likely to be forgotten when conveyed in a single statement heard, not read, once.

Mr. Berthon, in his endeavour to ascertain the neutral position for the aperture in his way-tube before referred to, unexpectedly obtained some very startling results, and these results, invariably repeating themselves through some thousands of experiments, established the following law, which has never been stated in any text-book of natural philosophy, and deserves the serious attention of all those interested in the action of induced currents. The law may be briefly stated thus:—

Let the circles *a*, *b*, *c*, *d*, denote different positions of the aperture in the way-tube, and assume the speed to be ten knots an hour. Then in *a*, $h = 4$ in. of mercury; in *b*, $h = 2$ in. of mercury; in *c*, $h = 6$ in.; and in *d*, $h = 0$, or zero.

In other words, with the aperture directly ahead, the column of mercury actuated by the column of water stands 4 in. above zero. When the aperture is turned directly astern the column of mercury falls 2 in. belw zero, or 6 in. lower than when the tube is in the first position. When the aperture is turned to the side, that is to say, into just the position where we would expect to find the motion of the ship powerless to affect the height of the column of mercury, there is absolutely the maximum effect produced, the column being lowered not less than 6 in. below zero, or 10 in. lower than when the aperture is right ahead. But the most extraordinary circumstance of all is that the zero angle is apparently constant for all circular tubes, and all shapes of aperture and all speeds, being invariably 41° 30′. Here, therefore, is plenty of matter for discussion.

Once in possession of these important facts, Mr. Berthon lost no time in turning them to account. A Berthon perpetual log is illustrated in a preceding diagram.

It was evident that by using two tubes—one always in the neutral position, and the other with the aperture pointing right ahead—it would become possible to eliminate the influence of the ship's draught altogether. The diagram shows the arrangement most convenient in practice, with this difference—that the two tubes A B are here shown, for the sake of clearness, removed to some distance from each other, whereas in practice they are placed close to each other, forming one compound tube, as in the drawing of the complete log. A and B are two air-vessels, into which the water, on filling the instrument, is allowed to rise half way. Above the air-vessels are air-tubes, communicating, as shown, with an inverted siphon half filled with mercury. Now, it is obvious that this arrangement is absolutely independent of draught, for suppose the ship to be suddenly sunk 10 ft. deeper than she was the moment before, the water rises to the same height in A and B, compressing the air in the chambers, and above the mercury, indeed; but the pressure on the surface of the mercury in each leg will remain identical. All forces, indeed, except that dependent on the resistance due to horizontal motion, act equally upon both sides of the column of mercury. But the aperture in A is turned forward, while that of B is placed in the zero position, 41° 30′. Let us call all the disturbing forces statical, and lump them together by a great S, and the force due to the ship's motion forward "dynamical D;" then we have S both in A and B, and B exerting an equal force at all times; but when the ship moves ahead we have in A, S + D, but in B we have only S + 0, therefore the mercury will rise in one leg and fall in the other, as already explained.

The mode of fitting this log to a ship is exceedingly simple. A small hole is bored through the keel, or near it; this is lined with a brass tube having at the top a stopcock and a small stuffing-box. The way-tube of the log is passed through the stuffing-box, which is made watertight around it, the stopcock meanwhile remaining shut. As soon as the stuffing-box is all right the plug is turned, and the way-tube passed down through the aperture in the plug till it projects 7 in. or 8 in. below the ship's bottom. A couple of composition tubes are then laid along the sides of the ship, like gaspipes, to the cabin, &c., and connected by small pieces of flexible pipe to the mercury gauge, hung in gimbals like a barometer, and occupying no more room. On this the speed of the ship can be read at any moment. Should the projecting end of the way-tube be broken off, it can be repaired again in ten minutes at a cost of a couple of shillings, without admitting a single drop of water to the ship. In practice the holes in the way-tubes are made very small, and the tubes themselves filled with sponge to exclude sand and dirt.

The author has now brought before this society nearly all the information worth recording about logs. If the subject is deemed sufficiently interesting to evoke a good discussion, he will rest well content with his labours.—*A Paper read before the Society of Engineers, and published in the "Engineer."*

Medicine as a Profession for Women.—The Earl of Shaftesbury presided on Monday over an influential meeting of the Victoria Discussion Society. The fitness of women for the medical profession was advocated by Dr. Drysdale in an able paper, which was followed by a discussion in which Miss Faithfull, Miss Garrett, Drs. Billing, Chapman, and Edmunds, Mrs. St. John, and Mr. Levy took part. Lord Shaftesbury concluded by adjourning the debate, saying that he was more and more convinced after the admirable speeches he had heard that night of the soundness of the movement which aimed at opening medical careers to women. Lord Houghton, Sir Charles Dilke, M.P., &c., have joined the Society.

REVIEWS OF BOOKS.

A Treatise on Medical Electricity, Theoretical and Practical, and its Use in the Treatment of Paralysis, Neuralgia, and other Diseases. By JULIUS ALTHAUS, M.D. Second Edition. Longmans. 1870.

IF even a cultivated physician were asked twenty years ago what he thought of electricity as a therapeutical agent, the reply would have been, in nine cases out of ten, "The merest *charlatanerie*." But times are changed, and now, thanks to the valuable researches of Remak, Du Bois Reymond, Matteucci, and Becquerel (*père*), the various forms of electric vibration are regarded by those who understand their several remedial qualities, as among the most useful means of cure and diagnosis which modern medicine possesses. We fear that there is still some little prejudice among the more ignorant of the "general practitioner" class against electricity, and we fancy that in many cases where this agent is employed it is used to gratify some whim of the patient, and not because the "surgeon" has any faith in it. But ignorance is the parent of prejudice, and that some of the provincial members of the profession—and a few also of their metropolitan brethren—are in Boeotian darkness on the subject of electricity is shown by the way in which, when pushed to do so, they apply it. We believe we do not exceed the limits of fact when we assert that a very large proportion of the country doctors look on electricity as something which is produced by "grinding" the handle of a sort of miniature barrel-organ, and that it is applied by putting two brass handles in the patient's hands. This seems, perhaps, to be an unfair exaggeration, but we appeal to the more learned in therapeutics if it is not a truthful picture. Yet, what brutal ignorance does not this demonstrate! Why, as well might a man suppose he understood his profession who would put a stethoscope on the patient's head, or an enema-tube into his mouth! Electricity presents itself under many guises; and while in one form it might be serviceable in certain affections, in another it might prove equally mischievous. And so, likewise, the modes of applying even one particular form of electricity are both numerous and necessary to be carefully distinguished.

For the reason we have stated, we welcome such works as that of Dr. Althaus, which, while they deal with the general principles of electrical physics, also teach us the application of electricity to practical therapeutics. In the edition of the work which is now before us, the author has very much enlarged the original book. Indeed, the present volume is more than three times the size of the old one. The author's additions have chiefly, however, related to the theoretical portion of his subject, which occupies very nearly one half of the whole book. The practical part has also received important additions, but it is not as full in regard to the typical cases of foreign physicians as we could have desired. In treating of the general subject of electro-physiology, Dr. Althaus is nothing if not critical, and he occasionally carries his criticism a little too fast and too far. There is a kind of flippancy in the way in which he disposes of the arguments of men whose lives have almost been devoted to electro-physiology which we do not like to see. We have the greatest respect for Dr. Althaus as an authority on electro-therapeutics, and this respect is all the more increased by our knowledge of the miserable superficiality which even some of the very "great guns" of medicine display. We know that Dr. Althaus thoroughly understands the subject which for years he has pursued with so much distinction. He must, therefore, fully comprehend the great difficulty of drawing definitive conclusions in regard to the theory of electric effects on the body; and for this reason he should be less dogmatic in the expression of opinions of his own, and more ready to forgive others for reticence. We are now pointing out the features in this fine treatise which seem to us objectionable, and while doing so we would take exception to some expressions which Dr. Althaus uses. Firstly, of the word *fluid*. No one knows better than the author that modern physicists have regarded this expression as founded on no basis of fact, and as calculated to lead to confusing ideas. Why, then, employ it? We want to instil into the minds of medical men some more philosophic notions of the laws of physics than they now possess; but how is this to be done if we speak of electric phenomena as the operations of a subtle "fluid." Again, what in the name of a rational natural philosophy does the author mean by the word "density" as separate from "intensity"? "Quantity" we know, and "intensity" we know, and "direction" we know to be important qualities of an electric discharge or current; but what is this "density"? Dr. Althaus tells us it is represented by the formula $D = \frac{I}{T}$ when I is the intensity, and T the transverse section of the conductive wire. But as we know the chief quality of a wire to be resistance (or conductivity, relatively), what does this supposed quality mean except the relation between intensity and resistance? and, if so, why hamper a difficult subject with a new and unnecessary technicality?

In regard to the description of the multiform batteries, coils, and machines now in use, Dr. Althaus gives a clear and ample description of all, and illustrates his remarks by numerous capital woodcuts intercalated with the text.

We note that in treating of the application of the induction currents, or of Faradisation, as he very properly calls it, in accordance with the modern nomenclature, Dr. Althaus lays stress on the position in which the poles are to be placed, making a distinction between positive and negative. Now we fancy this is a mistake, which is explained neither by theory nor practice. In the first place, in the coils generally in use, there is no provision by which the currents are sent in one direction, and as the currents are being perpetually reversed we cannot see that it makes the least difference which of the poles is applied near the affected part. Dr. Althaus may allege that the current on "making contact" and that on "breaking contact" are so disproportional in intensity that we really use only one. But this is not strictly true. As to the practical therapeutical application of the principle, we can assure him it is of no value. He will find, if he tries it in Faradisation, that it makes not the slightest difference (say in a case of rheumatic paralysis of the arm) to which end of the muscle he applies either of the poles.

We have thus far, we think, indicated nearly everything which we can find fault with in Dr. Althaus's treatise, and when it is remembered that the work covers nearly 700 pages, it will be seen that we find the book one which in every way is creditable to British Therapeutics. Dr. Althaus's style is clear and forcible; his reference to modern work is by no means behind-hand; his cases, selected from his own practice, are both numerous and illustrative; and thus, altogether, the volume before us is one which the scientific layman may read with advantage, and which will, we trust, do something to remove the lamentable obscurity which now exists in the minds of many English doctors as to the nature and extent of electro-therapeutics.

Sketches of Life and Sport in South-Eastern Africa. By CHARLES HAMILTON, F.A.S.L. Edited by F. G. PRICE, F.R.G.S., F.A.S.L. London: Chapman & Hall. 1870.

MR. PRICE has here jotted down the "yarns" which, from time to time, his friend Mr. Hamilton spun for him. The book contains a pleasant gossiping account of some travels in Kaffirland by one who is more of a sportsman than a philosopher. It has no scientific value whatever. The illustrations are not badly designed, but are execrably printed; and, among other objects of interest, they represent the author in the full dress of the country, and a Kaffir with a lady's

drawers worn as a vest. The editor recommends that missionaries to the Kaffirs should paint their skins with red-earth, wear a plume of feathers on the head, and be content with one garment, an apron of leopard-skin, which they might regard as a symbol of the Episcopate. He expresses his thanks to the Rev. Charles Carlos Clarke for his valuable assistance in preparing the work.

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Abrégé d'Arithmétique décimale, contenant toutes les Opérations du Calcul, etc. Nouvelle Edition, augmentée d'un Précis historique sur les nouvelles Mesures. Par F. P. B. Tours. Mame et Fils.

Abrégé de Géométrie appliquée au Dessin linéaire à l'Arpantage, au Nivellement et au Lever des Plans. Suivi des Principes de l'Architecture et de la Perspective. Par F. P. B. A l'usage des Écoles chrétiennes. Paris. Poussielgue Frères.

Beautés du Spectacle de la Nature, ou entretiens sur l'Histoire naturelle des Animaux et des Plantes. Par Pluche. Ouvrage mis au Niveau des Connaissances actuelles. Par L. F. Jéhan. 10e Edition. Tours. Mame et Fils.

Canal et Port Saint-Louis et Jonction du Rhône à la Méditerranée. Par Max Berthaud. Paris. J. Baudry.

Détermination de la Mortalité dans les différants Milieux, ou Méthode pour calculer la Mortalité d'une Collectivité pendant son Passage dans un Milieu déterminé, que ce Milieu soit la Société elle-même ou qu'il soit une Prison, un Asile, une Ecole, un Hospice, ou un Hôpital. Par le Docteur Bertillon. Strasbourg. Ve. Berger-Levrault.

Les Oiseaux migrateurs, extraits d'un Ouvrage inédit de M. Berthelot. Paris. Martinet.

L'Hygiène de la Vieillesse et les Conseils pour la Longévité. Causeries du Dimanche. Par le Docteur Debourge. Montdidier. Mérot.

Régénération des Vers à soie et notablement des Vers à soie de Pays. Rapport présenté à la Chambre de Commerce de Lyon. Par L. G. Delerue, Ingénieur du Service municipal de Lyon. Lyon. Storck.

Traité d'Anatomie descriptive. Par G. Cruveilheir, Professeur honoraire à la Faculté de Médicine de Paris. 4e Edition, revue, corigée et considérablement augmentée, avec la Collaboration de MM. les Docteurs Marc Sée et Cruveilhier fils. Paris. Asselin.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

Sir William Thomson *versus* Geology.—*From* P. W. Stuart Menteath.

Sir,—I regret that other occupations have obliged me to suspend for a little my treatment of this matter. I thought that it might, without inconvenience, be delayed. In resuming it I shall make use of such articles bearing on the question in hand as I happen to have met with since the date of my last letter. These articles have led me to consider the matter as of much greater practical importance than I had previously supposed; and I shall, in consequence, modify my method of dealing with it. I must ask your readers to consider my letters as intended to form one whole, in which, what is left unsatisfactory in one, will be found complemented in another. In no other manner can I hope to render the question generally intelligible; and I trust that your correspondents will not ask for demonstration where demonstration is not *necessary to the argument*, or imagine that mere conjectures must always be rebutted by strict science. Those who would do this I refer to the commencement of my first letter, where my purpose in entering into this ridiculous discussion was stated in unmistakable terms. Had I intended to propound a new and serious theory of volcanic action, fully justified by new facts, and a complete criticism of the state of the subject, I should have written, not to the correspondence of a scientific journal, but either to the French Academy or to the Geological Society of France. Practical knowledge of volcanic phenomena and acquaintance with a large proportion of what has been written on the subject have led me to consider that any attempt to treat it scientifically would require more space than any correspondence could allow; and while I may offer *suggestions*, rebut shallow dogmatism, answer one-sided quotations from popular lectures or textbooks, or even compare with *facts* such clippings from a particular scientist's treatise as may have been misused in the bolstering up of a one-sided theory,—I must decline to attempt the impossible, or to be distracted by *A Tale of a Tub*. So much as is necessary to my argument I will readily answer to "R. A."; but, considering the width of the subject in hand, I must really give *no more*.

As regards the importance of the subject, I would remark that Sir W. Thomson has been endeavouring for nearly ten years to obtain the reputation, without undertaking the labour, of a reformer in geology; I would point to the professedly authoritative article in the *North British Review* (July, 1869) containing, among other remarkable matter, a gross insult to the memory of Hamilton, and the following singular statement:—"In truth, when we come to examine the question as a whole, giving its full weight to each of the separate details, we find that we may, with considerable probability, say that natural philosophy already points to a period of some *ten* or fifteen millions of years as all that can be allowed for the purposes of the geologist and palæontologist; and that it is not unlikely that, with better experimental data, this period may be still further reduced." I would point to the article in the *Edinburgh Review* (January, 1870), and to the following statement in the *British and Foreign Evangelical Review*:—"This is a concession for argument's sake, or rather for brevity's sake. A past, for the material world, without interposition of precisely such a kind as theologians indicate by the word miracle, is thoroughly out of the question. The modern doctrine of energy, and the mathematical theory of heat, have set that at rest for ever by irrefragable demonstration—as we should like to take an early opportunity of setting before our readers. There are no such bigots going as a certain noisy sect of naturalists." (January, 1870). These writings are sufficient proof that Sir W. Thomson has succeeded in attracting attention, and that geology must show cause for disregarding his claims as a reformer. Professor Huxley has defended the geology of the future; I propose to defend the geology of the present.

Let us suppose a man of ordinary education and intelligence to read the writings above mentioned; what notion would he form of the character and the worth of geology? In what state of mind would he rise from their perusal? Let us suppose that, disgusted with geology, he turned for true science to Professor Sylvester's ex cathedrâ *Plea for the Mathematician*. On that plea I shall, by-and-by, be obliged to touch; for the present may I not submit to your readers that the last state of the man we have supposed would be worse than the first? Sir W. Thomson may assure himself that, when forced into the discussion of these matters, geologists are by no means unprepared to discuss them. Whether Sir W. Thomson is right in insisting that their discussion is profitable, or whether the geologists are right in insisting that it is not, may, at least, be thus decided.

The tendency of the modern analysts is certainly to return to "the considerations of abstractions as the only true material of science," and it appears by Professor Sylvester's *Plea* that Pythagoras is rising into wonderful repute; but it has been reserved for Sir W. Thomson to revive the disputes of Platonists *versus* Aristotelians, and to insist that such matters should be "thoroughly sifted" by geologists. Hence this dispute; and, as the *North British Reviewer* beautifully says, "Thus Uniformitarianism has received its death-blow, and the operation has been performed as a duty, cheerfully but considerately, without malignity or ostentation."

But from Duns Scotus to Hamilton there has been preserved in Scotland a tradition of common sense. Believing that tradition to have been known to Napier, Newton, Berkeley, Kant, Hume, Reid, Stewart, Hamilton, Hutton, and other Scotchmen, and that it is not wholly forgotten now. I shall endeavour to continue the discussion on the principles of *that*.

Is the science of Newton, of Pascal, or of Faraday, at all similar to the science of the modern analysts (who despise the geometry that Newton prized, and prize the mechanical analysis that Newton despised)? Has the last the same object as the first? And, if not, to which is the name of *science* to belong? Is the *corruptio optimi* a necessary law of nature; or may even a Uniformitarian protest against the recurrence of a Kabbalistic Period in science? Anyhow, an attempt to dispel certain confusion cannot be altogether useless,—and the need that this be attempted is now certainly felt.

The whole secret of the discussion that Sir W. Thomson's persistent

efforts have raised, is contained in the following paragraph, which I translate from the *Pensées de Pascal* (Renouard, 1812):—"For how many persons believe that they have defined time when they have said that it is the measure of motion, leaving to it, meanwhile, its ordinary sense? and, nevertheless, they have made a *proposition* and not a definition. How many are there, likewise, who believe they have defined motion when they have said:—*Motus nec simpliciter motus, non mera potentia est, sed actus entis in potentia?* And yet, if, as they do, they leave to the word *motion* its ordinary sense, they have not made a definition, but a proposition; and thus confounding those definitions which are called *definitions of names*, and which are the true, free, allowable, and geometrical definitions, with those which are called *definitions of things*, which are properly propositions by no no means free, but subject to contradiction,—they allow themselves freely to form these as well as the others: and each one defining the same things after his own fashion, with a liberty which is as much forbidden in these last definitions as allowable in the first, they confuse all things; and, losing all order and all light, they lose themselves, and wander in inexplicable difficulties." Pascal's censure applies strictly to Sir W. Thomson, and by no means to the geologist. But when the *North British Review* can coolly assume—in the country of Hamilton—that the metaphysicians are "mere soap-bubbles," and when such meaningless pedantry as Sir W. Thomson's demand of the geologists, "On what calculations is this opinion founded" (Reply), can be allowed in a professedly scientific writing, Pascal's thoughts cannot be expected to command much attention; and I shall, therefore, continue to treat the question in hand in such a manner as I hope may answer best. Before continuing I shall, however, reply as briefly as possible to such objections as have appeared, hoping to satisfy such objections more fully in the sequel.

First, as regards "R. A.'s" letter in SCIENTIFIC OPINION of December 15th, 1869. "R. A.'s" manner of employing inverted commas may, I submit, lead to misconception. I had referred to a former letter, in which I suggested a view, which I submitted as justified by the facts concerning the question. To that letter I refer "R. A.;" and if he will show cause, by crucial facts and crucial reasoning, that what I there spoke of may not be admitted as "*a vera causa* that cannot be neglected," &c., I shall be most happy to join issue with him. As I have already remarked, I find I must keep as much as possible to the question in hand: without too much departing from it, my entering into details in answer to "R. A.'s" queries could only be special pleading. I give below the names of a few of the works in which he can find facts concerning the question; from those facts he may draw his own conclusions.[1] Sir W. Thomson accuses Lyell of supposing a perpetual cycle: I point to a condition of the question which no geologist can ignore, and which throws the inference of perpetual motion out of court.

If "R. A." requires that I give a quantitative estimation of the relation of the cause to the results to be accounted for, I may fairly ask him to furnish me first with a quantitative estimation of those results. But as it is the business of geologists to deal with facts of observation and not the assumptions of particular speculators, it will not do to *assume* quantities and *suppose* conditions, and then draw conclusions by somebody's "beautiful" formula. In my next letter I shall endeavour to make it CLEAR why geologists have not considered the results obtained by Fourier and others, as deserving of serious consideration in their speculations; and I shall endeavour to show that while they willingly allow the *use* of mathematics, they know also that mathematics may be abused—that it is not because they are ignorant of mathematics, but because they are acquainted with the facts of geology, that they refuse to rush to conclusions such as those brought forward by Sir W. Thomson.

As regards electricity, and the part that may probably be assigned to it in the production of internal heat—the mathematician might suppose and assume regarding the earth's magnetism, or he may entirely ignore it for the convenience of a formula; but the geologist may show that the evidence of strong electric currents in the interior of the earth, is not much less satisfactory than the evidence of original heat,—and he may require the mathematician to show clear and exact reasons for ignoring them, when the mathematician pretends to produce clear and exact results regarding internal heat. Faraday's magneto-electric researches forbid the ignoring of electricity, when we speak of the earth *as it is*, not as the mathematicians may find it convenient to define it.

With reference to "R. A.'s" second paragraph—I would here merely remark that if the theory of the dissipation of energy does not fit the facts of nature ascertained by naturalists, it follows that the theory must be abandoned, not that the facts must be discredited. Does it fit the facts or not is the question to be decided; if this is not the question, on what then does the theory rest, except that it suits the speculations of Sir W. Thomson, and that *he* knows nothing against it?

As to "R. A.'s" concluding sentence, I would call his attention to the fact that, twenty years ago, Hitchcock could write as follows:—"Yet even in astronomy, it is not many years since the mutual disturbances among the heavenly bodies were supposed to be the certain precursors of ruin to the system." And sixteen years ago the *North British Review* (in an astronomical article) contains this:—"As neither reason nor religion leads us to believe that the solar system will ever be destroyed, or that living beings will ever cease to occupy the earth." How, then, as to "all the great natural laws which as children," &c.; and are there not some curious *cycles* in astronomical history?

"An Old Stager" having answered the greater part of "A Young Beginner's" letter, I need only notice a few sentences in it which specially concern myself.

As to my heading—had Sir W. Thomson endeavoured to show, by a critical examination of the subject, that the Uniformitarians were false to their science and the Catastrophists true to it, I should have admitted that he attacked a particular theory. As it is, he attacks the whole value and method of geological reasoning. But I hope to show that Uniformitarianism is no mere theory.

I spoke of the "*clear possibility*" that the geological record, &c.: it is a clear possibility, as far as geology is concerned, until geological reasons are produced against its possibility; I know of none. On the other hand, it should be shown how metamorphism *could* remain inactive; and that has not been shown.

I object to any limit to geological time simply because I hold that not the slightest reliable proof of any limit has been found. Let any evidence be produced and I will either show it inadmissible or consider its weight. Sir W. Thomson's evidence I have to continue the examination of. I wish for either satisfactory facts and reasonings, or else for suspension of judgment. I have studied zoology, and read Darwin's book; therefore, I am a Darwinian; but *progress* in life requires defining, and all our notions of it seem very vague.

As regards the form of the earth, I referred to the well-known *Manual of Geology* of Professor Jukes. The view is also discussed in Lyell's *Principles*; and it may be found explained and admitted in astronomical works. It has been often ignored in the bolstering up of one-sided theories; but, so far as I have been able to ascertain, it has never been refuted. Denudation is moreover not the only process that justifies its admission. But, to the Uniformitarian, no explanation of the earth's form is required: he knows no reason for supposing that the shape of the earth was primævally bungled.

My argument is this:—(1) That the matters on which Sir W. Thomson is "quite certain" are in reality so extremely obscure that no definite conclusion can fairly be drawn from them, unless they be utterly misrepresented by the modern analyst: that, therefore, Sir W. Thomson's position is a proof of presumptuous ignorance, while the position of the geologists is justified by enlightened common sense. (2) That there are other considerations which positively justify Uniformitarianism; and that, further, Uniformitarianism is a necessary principle of common sense.

The wisdom of the Egyptians, backed by the rhetoric of the Cagliostros, may command for a time the admiration of the vulgar; but if England, from a nation of *βανανσοι*, is to become a nation of men, she will recognize in intelligence but one "proud pre-eminence"—of the eternal attribute of common sense.

I remain, &c.,

St. Jean de Luz, March 5. P. W. STUART MENTEATH.

[1] *De l'Azote et des Matières organiques dans l'Ecorce terrestre.* Delesse. Bischof's *Chemical and Physical Geology.* Daubeny's *Treatise on Volcanoes.*

PROFESSOR TYNDALL'S RESEARCHES ON HEAT.

SIR,—In connection with the above subject there is a point on which I desire to offer a few critical remarks. In an experiment intended to show the distribution of heat in the electric light, the thermo-electric pile was coated with lampblack. I would submit that, in order that a substance should show correctly the distribution of heat from any source, it is necessary that that substance should absorb rays of the different wave-lengths proportionally, *i.e.*, the rate of heat absorbed to non-absorbed (dispersed or transmitted) heat should be a constant quantity for rays of varying refrangibility. In the previous part of the work, *Heat as a Mode of Motion*, it is stated that lampblack is, to a great degree, transparent to rays of low refrangibility, of which a considerable proportion exists in the electric light. It would follow from the above that lampblack cannot show correctly the distribution of heat in the case referred to.

I am yours obediently, NEMO.

Members of Oxford University who desire to offer themselves as candidates for the Whitworth preparatory exhibitions are to send in their names to the Rev. C. L. Wingfield, All Souls' College, on or before Saturday, March 19, together with a statement of distinctions, if any, gained in mathematics or experimental science in the University or in any College or Hall.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, MARCH 10TH.—The following papers were read:—"On the Contact of Conics with Surfaces," by William Spottiswoode, M.A., F.R.S.

"Researches on Solar Physics.—No. II. The Positions and Areas of the Spots observed at Kew during the years 1865-66, also the Spotted Area of the Sun's visible disk from the commencement of 1832 up to May, 1868," by Warren De La Rue, Esq., Ph.D., F.R.S., F.R.A.S., Balfour Stewart, Esq., LL.D., F.R.S., F.R.A.S., Superintendent of the Kew Observatory, and Benjamin Loewy, Esq., F.R.A.S.—The paper commences with a continuation for the years 1864-66 of Tables II. and III. of a previous paper by the same authors; it then proceeds to a discussion of the value of the pictures of the sun made by Hofrath Schwabe, which had been placed at the disposal of the authors, and the result is that these pictures, when compared with simultaneous pictures taken by Carrington and by the Kew heliograph, are found to be of great trustworthiness. From 1832 to 1854 the pictures discussed are those of Schwabe, who was the only observer between these dates; then follows the series taken by Carrington, and lastly the Kew series, which began in 1862.

A list is given of nine values of the sun's spotted area for every fortnight, from the beginning of 1832 up to May, 1868, and also a list of three-monthly values of the same, each three-monthly value being the mean of the three-fortnightly values which precede one of the three which follow it. These three-monthly values are also given for every fortnight.

A plate is appended to the paper, in which a curve is laid down representing the progress of solar disturbances as derived from the three-monthly values; and another curve is derived from this by a single process of equalization, representing the progress of the ten-yearly period. The values of the latter curve, corresponding, to every fortnight, are also tabulated.

"Tables of the Numerical Values of the Sine-integral, Cosine-integral, and Exponential Integral," by J. W. L. Glaisher, Trin. Coll., Cambridge.

"On some Elementary Principles in Animal Mechanics.—No. III. On the Muscular Forces employed in Parturition," by the Rev. Samuel Haughton, M.D., Fellow of Trinity College, Dublin.—In the first stage of natural labour, the involuntary muscles of the uterus contract upon the fluid contents of this organ, and possess sufficient force to dilate the mouth of the womb, and generally to rupture the membranes. I shall endeavour to show, from the principles of muscular action already laid down, that the uterine muscles are sufficient, and not much more than sufficient, to complete the first stage of labour, and that they do not possess an amount of force adequate to rupture, in any case, the uterine wall itself.

In the second stage of labour, the irritation of the fœtal head upon the wall of the vagina provokes the reflex action of the voluntary abdominal muscles, which aid powerfully the uterine muscles to complete the second stage by expelling the fœtus. The amount of available additional force given out by the abdominal muscles admits of calculation, and will be found much greater than the force produced by the involuntary contractions of the womb itself.

The mechanical problem to be solved for both cases is one of much interest, as it is the celebrated problem of the equilibrium of a flexible membrane subjected to the action of given forces. It has been solved by Lagrange (*Mécanique Analytique*, p. 147) in all its generality. In the most general case of the problem, the following beautiful theorem can be demonstrated:—Let T denote the tensile strain acting in the tangential plane of the membrane, applied to rupture a band of the membrane 1 in. broad; let P denote the pressure resulting from all the forces in action, perpendicular to the surface of the membrane, and acting on a surface of 1 square inch; and let ρ_1 and ρ_2 denote the two radii of principal curvature of the membrane at the point considered. Then we have the following equation:—

$$P = T \times \left(\frac{1}{\rho_1} + \frac{1}{\rho_2} \right).$$

If the surface, or a portion of it, become spherical, the two principal curvatures become equal, and the equation becomes

$$P = \frac{2T}{\rho}.$$

In the case of the uterus and its membranes, the force P arises from hydrostatical pressure only, and is therefore easily measured, and the supposition of spherical curvature is approximately admissible.

It is evident from the form of the gravid uterus, that its curvature is greatest near its mouth; and the equation shows that for a given hydrostatical pressure the tensile strain is proportional to the radius of curvature; hence this strain will be greatest at the fundus of the uterus, in which part, accordingly, we find the muscular coat thicker than elsewhere. If we assume the shape of the uterus to be that of a prolate ellipsoid, whose longer diameter is 12 in., and shorter diameter 8 in., its mean curvature will be that of a sphere whose diameter is 9·158 in.

The volume of the gravid uterus is found from the expression

$$\text{Volume} = \frac{4}{3} u\, a\, b^2;$$

in which a and b are the semiaxes, and u is the ratio of the circumference of a circle to its diameter; substituting for a and b their numerical values, we find the contents of the uterus to be 402·13 cubic inches.

The surface of the gravid uterus may be found from the equation

$$\text{Surface} = \frac{2\,u\,ab}{e} (\sin^{-1} e + e\sqrt{1-e^2});$$

in which e is the excentricity of the generating ellipse. If the numerical values be substituted in this expression, it will be found that the surface of the uterus is 270·66 square inches.[1]

Some highly interesting conclusions may be drawn from the preceding calculations, combined with the weight of the total muscular tissue of the uterus. Heschl estimates the weight of the uterine muscles at from 1 lb. to 1·5 lb., Montgomery found the muscles of the gravid uterus to weigh 1·5 lb., and Levret estimates them at 51 cubic inches, which, with a specific gravity of 1·052, I find to be equivalent to 1·93 lb. Taking the mean of these estimates we have:—

Weight of Muscular Fibres of Gravid Womb.

	lb.
Heschl	1·25
Montgomery	1·50
Levret	1·93
Mean	1·56

If we now suppose this quantity of muscle to be spread over the entire surface of the uterus we find—

$$\text{Mean thickness of muscular wall of uterus} \left\{ \frac{1{\cdot}56 \times 7000 \times 1000}{252{\cdot}5 \times 270{\cdot}66 \times 1052} \right\} = 0{\cdot}1519 \text{ inch.}$$

If we suppose a ribbon, 1 in. in width, to be formed from the wall of the uterus, its thickness will be 0·1519 in.; and as each square inch of cross section of muscular fibre is capable of lifting 102·55 lb., we find for the greatest tensile force producible by the contraction of the uterine muscles:—

$$\text{Tensile strain of uterine wall per inch} \left\{ \right. \ldots\ldots 102{\cdot}55 \times 0{\cdot}1519 = 15{\cdot}577 \text{ lb.}$$

Substituting this value of T in the equtation

$$P = \frac{2T}{\rho},$$

and for ρ its mean value 9·158 in., we obtain the maximum hydrostatical pressure inside the gravid uterus, that can be produced by the contraction of its muscular fibres:—

$$\text{Maximum hydrostatical pressure produced by uterine contraction} \left\{ \frac{2 \times 15{\cdot}577}{9{\cdot}158} \right. = 8{\cdot}402 \text{ lb.}$$

This pressure, applied to a circular surface of 4½ in. in diameter, is equal to 54·106 lb. One hundred experiments were made by Duncan and Tait upon the hydrostatical pressure necessary to rupture the membranes which contain the liquor amnii, which are recorded in Dr. Duncan's book[2] (pp. 306-311). The greatest pressure observed was 3·10 lb., and the least was 0·26 lb.; and I find that the mean rupturing pressure of all their experiments was 1·2048 lb.

Combining this experimental result with the calculation already given of the amount of pressure producible by the muscular tissue of the womb, we may conclude that the uterine muscles are capable of rupturing the membranes in every case, and possess, in general, nearly three times the amount of force requisite for this purpose.

In the second stage of labour, the voluntary action of the abdominal muscles is called into play to aid the expulsive efforts of the uterine muscles. I have attempted to calculate the force available from the contraction of these muscles as follows:—

The abdominal muscles are four in number; viz., *rectus abdominus*, *obliquus externus*, *obliquus internus* and *transversalis*. The last three muscles form curved sheets, acting upon the corresponding muscles of the opposite side by means of tendinous *aponeuroses* which meet in the linea alba, and form the sheath of the vertical *rectus abdominus*

[1] Levret estimates the contents of the gravid uterus at 408 cubic inches, and its surface at 339 square inches. Poppel estimates the contents at 300 cubic inches, and the surface at 210 square inches.

[2] *Researches in Obstetrics.* Edinburgh, 1868.

muscle. From the arrangement of all four, it is plain that the tensile force of muscular contraction in the curved wall of the belly, from the xiphoid cartilage to the symphisis pubis, is to be measured by the sum of the united forces of all the muscular sheets. If we knew the force of each muscle, and the principal curvatures of the belly in the middle line, we could calculate by Lagrange's theorem, the hydrostatical pressure inside the abdominal cavity and available to expel fæces, urine, or a fœtus.

In order to ascertain the force of the muscles, I measured carefully their average thicknesses in three subjects, of whom one was a young woman who had borne children, and the others were men of ordinary size and appearance. The results obtained were the following:—

Thicknesses of Abdominal Muscles.

	No. 1. Male.	No. 2. Female.	No. 3. Male.
	in.	in.	in.
Rectus abdominus.....	0·275	0·29	0·34
Obliquus externus.....	0·200	0·25	0·19
Obliquus internus	0·235	0·17	0·24
Transversalis.....e.....	0·127	0·15	0·14
Total.....	0·837	0·86	0·91

The average total thickness of the muscular walls is 0·869 inch, which is nearly identical with the measurent obtained from the female subject. It has been ascertained by careful observations, that we must add 50 per cent. to the weights of muscles in the dead subject in order to bring them to the living weights; this correction gives us 1·3035 inch for the mean thickness of the muscles causing tension in the central line of the belly, where the forces of all the muscles come into play together. Multiplying this thickness by 102·55 lb., or coefficient of muscular contraction, we find

$$T = 1{\cdot}3035 \times 102{\cdot}55 = 133{\cdot}67 \text{ lb.}$$

This is the tensile strain producible by the contraction of the abdominal muscles along the curved central line of the belly.

It remains now to ascertain the principal curvatures of the abdominal surface, and to use the equation—

$$P = T\left(\frac{1}{\rho_1} + \frac{1}{\rho_2}\right)$$

so as to determine P, the hydrostatical pressure per square inch inside the cavity of the belly, and available, either in whole or in part, for the expulsion of the fœtus during the second stage of labour.

In order to ascertain the curvature of the belly, I made experiments on three young men placed lying on their backs upon the floor, and made them depress and raise the abdominal wall as much as possible. The result was as follows:—Taking a straight line from the upper part of the symphisis pubis to the xiphoid cartilage as the fixed line of comparison, it was found possible to depress the navel one inch below this fixed line, and to raise it two inches above it. When the belly was distended to the utmost by the action of the abdominal muscles, I measured the longitudinal and transverse curvatures by measuring the sagittas corresponding to a given length of tangent, with the following results:—

Number.	Diameter of longitudinal curvature.	Diameter of transverse curvature.
	in.	in.
J. G. H.	22·93	12·30
H. O.....	22·78	12·80
S. H.....	22·52	12·80
Mean.....	22·727	12·633
	Fat	Fat .....

The curvature of the distended belly at the navel is found to be, from the foregoing measurements,—

$$\frac{1}{\rho_1} + \frac{1}{\rho_2} = \frac{1}{11{\cdot}3635} + \frac{1}{6{\cdot}3166} = \frac{1}{4{\cdot}0596}.$$

Multiplying this curvature into the tension of the abdominal muscles at the navel already found, viz., 133·67 lb. per inch, we obtain, finally,

$$P = \frac{133{\cdot}67}{4{\cdot}0596} = 32{\cdot}926 \text{ lb. per square inch.}$$

This amount of expulsive force per square inch is available, although not usually employed, to assist the uterus in completing the second stage of labour. If we suppose it applied to the surface of a circle 4¼ in. in diameter (the usual width of the pelvic canal), we find that it is equivalent to 523·65 lb. pressure.

Adding together the combined forces of the voluntary and involuntary muscles, we find—

Involuntary muscles	= 54·106 lb.
Voluntary muscles.....	= 523·65 ,,
Total	577·75 ,,
Fat.....	

Thus we see that, on an emergency, somewhat more than a quarter of a ton pressure can be brought to bear upon a refractory child that refuses to come into the world in the usual manner.[8]

In order to determine by actual experiment the expulsive force of the abdominal muscles, I placed two men, of 48 and 21 years of age respectively, lying on a table upon their backs, and and put a disk measuring 1·87 inch diameter just over the navel; weights were placed upon this disk and gradually increased until the extreme limit of weight that could be lifted with safety was reached; this limit was found to be in both cases 113 lb. As the circle whose diameter is 1·87 inch has an area of 2·937 square inches, the pressure perpendicular to the abdominal wall produced by the action of the abdominal muscles is

$$P = \frac{113}{2{\cdot}937} = 38{\cdot}47 \text{ lb. per square inch,}$$

a result which differs little from that found by calculation from the actual measurements of the muscles and curvatures.

ETHNOLOGICAL SOCIETY.

March 8th.—Prof. Huxley, president, in the chair. Capt. Campbell, R.E., was announced as a new member. Col. Lane Fox read a paper "On the Opening of Two Cairns near Bangor, North Wales."—One was situated on the summit of Moel Faben, and contained a cist in which an urn was found, together with several small dressed stones, probably arrow-heads and flakes, worked not in flint, but in the trap and felspathic rocks of the neighbourhood. Other worked stones were found beneath the cist. The characters of the materials were described by Prof. Ramsay. The second cairn examined by the author was called Carnedd Howel, and contained fragments of an urn surrounded by particles of burnt human bone, but not protected by a cist. Among the speakers who took part in the discussion on this paper were Sir. J. Lubbock, Bart., M.P., Prof. Ramsay, Mr. J. Evans, Mr. J. W. Flower, Dr. Nicholas, and Mr. R. Hamilton. A paper was then read "On the Earliest Phases of Civilization," by Mr. H. M. Westropp. The author sought to show that every race passes through an invariable series of phases in definite sequence—the barbarous, the hunting, the pastoral, and the agricultural phases, which the author compared with the respective stages of infancy, childhood, youth and manhood in the individual man. Numerous illustrations were adduced of different races exhibiting these several phases of civilization in the successive stages of their development.

ROYAL HORTICULTURAL.

March 2nd.—W. W. Saunders, Esq., F.R.S., in the chair. The usual preliminary business being concluded, Mr. Moore, in the absence of the Rev. J. Dix, announced the awards of the floral committee, and Mr. Geo. F. Wilson those of the fruit committee. The chairman then proceeded to make some comments upon some of the productions sent to the meeting, and first elicited the thanks of the society to Mr. Fernyhough, a member of the floral committee, for his handsome present to the society of a series of coloured sketches of tropical fruits; and then directed attention to several forms of variegation in Abutilons, of which further notice will be found in the report of the scientific committee; and to several of the Orchids exhibited. A species of Agave was alluded to as belonging to a class of plants well adapted, when grown as specimens, for placing on pedestals. Some few years ago, said Mr. Saunders, we were contented with about 10 or 12 species of Agaves, but he had since increased his collection to about 120 species or varieties. The curious *Stangeria paradoxa*, a Cycadaceous plant from Natal, was then referred to as having been thought to be a fern when first introduced into this country, but afterwards was properly described by Mr. Moore. The usefulness of ivies for decoration in winter was commented upon, and the chairman concluded his remarks by stating that he was glad to see that this class was being taken in hand by several horticulturists. Major Trevor Clarke said he had examined all the Cyclamens in a collection from Mr. Wiggins, and had not found one that was fragrant, he thought that, as a matter of floral criticism, fragrance should be thought as much of as form.

Scientific Committee.—W. W. Saunders, Esq., F.R.S., in the chair. The minutes of the last meeting having been read, a report of the sub-committee appointed to superintend the experiments carried on with various manures at Chiswick was read and adopted. Dr. Gilbert spoke on the same subject, and it was agreed that the carrying out of certain details, as to the proportion of the ingredients to be used in the several boxes, should be left to Drs. Gilbert and Voelcker. The question of the employment of a special assistant to superintend the experiments for the ensuing season was discussed, and the chairman

[8] The preceding result will no doubt remind the curious and well-informed reader of the statement made by Mr. Shandy, on the authority of *Lithopædus Senonensis de partu difficili*, that the force of the woman's efforts in strong labour pains is equal upon an average to the weight of 470 lb. avoirdupois, acting perpendicularly upon the vertex of the head of the child.

promised to bring the subject under the notice of the council for its determination at its next meeting.

Dr. Masters exhibited, on the part of Messrs. Downie, Laird, & Laing, a number of grafted Abutilons, showing the effect of stock on scion, and scion on stock. Thus, *Abutilon megapotamicum* (green) grafted on *A. Thomsoni* (variegated) had become variegated like the stock; *A. Thomsoni* grafted on *A. megapotamicum* had caused the production of variegated shoots from the originally green stock as well as from the scion; *A. Thomsoni* grafted on *A. megapotamicum* and then pinched back had the effect of inducing the buds on the stock to break, and these two produced variegated leaves. Another green Abutilon, "Duc de Malakoff," grafted on *A. Thomsoni*, also became variegated in consequence. So that the variegated plant, whether used as a stock or as a scion, has the faculty of imparting its variegation to the leaves and buds subsequently produced. Great interest was manifested in these specimens, and Dr. Masters called attention to the remarkable experiment of M. van Houtte, where the variegation ceased after the accidental removal of the variegated graft (see p. 554, 1869), and to a paper of Professor E. Morren's, lately published, recording several cases of this kind mentioned in this and other journals, and also to the circumstance that the mere insertion of a detached leaf of *A. Thomsoni* into a slit in the bark of a green Abutilon, was sufficient to inoculate the latter, even though the inserted leaf speedily perished. Dr. Masters stated that, at a future meeting, he would direct attention to other recorded cases of this interesting phenomenon.

A specimen of a curious excrescence from the bark of a camellia, sent by Mr. Mills, of Enys Gardens, Penryn, was then shown. The excrescence had much of the aspect of a Polyporus, but seemed to be an excrescence from the bark, from which it was with difficulty separated. In one case two branches had become united together, and the point of union was covered with this shell-like excrescence. None of the members of the committee, nor any of the camellia-growers present at the general meeting, had ever seen anything similar. The only suggestion was that the adventitious growth was the result of some injury to the plant. Dr. Masters undertook to submit the growth to microscopic examination, and report more fully at a future meeting; as also on a curious specimen resembling the "burrs" seen on birch-trees, but in this case stated to be formed on the roots of a currant-bush. Dr. Masters further reported as follows, on the *Bridgesia spicata* exhibited at the last meeting:—

"The peculiar out-growths of this plant are protruded from the young shoots above the axils of the leaves, and above the branch proceeding therefrom. In the fully developed state they are about the size of a large pea, of a yellowish colour, and have a general resemblance to the tufts of hairs found in similar situations in Pereskia.

"In the youngest condition the excrescences occur in the form of small, smooth, conical projections, covered with an outer layer of small oblong cells, the outer walls of which are thickened; subjacent to these are four or five rows of small, spheroidal, densely-packed cells, also cortical in their nature. These overlie a mass of ordinary cellular tissue, the cells of which contain chlorophyll. Running into this conical cellular projection are two rows of small spiral vessels, which converge towards the apex of the cone, and form a loop. These spiral vessels are continuous with those of the vascular circle of the branch, and are surrounded on all sides by oblong thin-walled cells, whose long diameter is parallel to that of the spiral vessels, and more or less at right angles to the direction of the parenchymatous tissue of the cortex and also of the medulla. The constituent cells of the medulla are spheroidal, and destitute of chlorophyll. Here and there spiral vessels traverse the medulla, quite isolated from the general vascular circle. In the more fully-developed excrescences the appearances are similar, except that the outer epidermal cells now show themselves in the form of long cylindrical cells (hairs), some of which are club-shaped at the extremity. Some of these hairs appear to be uni-cellular, while others show one or two transverse partitions. The hairs in question are rather thick-walled, and contain a few scattered small highly refracting granules (starch?) resembling the granules found in autumn when the leaves have assumed their autumnal tints in consequence of the decay of the chlorophyll.

"From these appearances the inference seemed to be that the growths in question were of the nature of adventitious roots covered by hypertrophied epidermal hairs."

An Arum from Chiswick with an adventitious leaf attached to the spadix, and white, like the spathe, was then shown. A similar illustration was forwarded some time since by Mr. T. D. Fish.

Mr. A. Murray read a communication relating to the presence of a larva in the tubers of certain herbaceous perennials. The larva in question was that of the Ghost Moth or Golden Swift, *Hepialus sp.*, and did much damage. Mr. Murray then showed a dipterous larva which was attacking Seakale roots, and doing much mischief. This was referred to Professor Westwood, for further examination.

Specimens of the Pine Beetle and of a species of Tortrix were then shown. A "Rose Scale," supposed to be new, was also shown by Mr. Murray, who also alluded to the curious mite, *Oribata geniculata*, already referred to in these columns.

Mr. G. F. Wilson exhibited a series of water-colour drawings of tropical fruits which had been presented to the society by Mr. Fernyhough, and the meeting then adjourned.

Floral Committee.—Charles Lee, Esq., in the chair. This was in all respects a very successful meeting, numerous prizes being offered for competition.

THE INSTITUTION OF CIVIL ENGINEERS.

March 1st.—Charles B. Vignoles, Esq., F.R.S., president, in the chair. The paper read was on "The Wolf-Rock Lighthouse," by Mr. Jas. N. Douglass, M. Inst. C.E. After giving a number of mechanical details the author gave the following account of the light:—

The lantern was one of the cylindrical helically-framed type, designed by the author, and adopted by the Trinity House. It was manufactured by Messrs. S. Hodge & Sons; while the curved plate-glass for glazing it, and the dioptric apparatus, were manufactured by Messrs. Chance Brothers & Co. The instrument was probably the most perfect for the purpose that had yet been constructed. With the view of giving the Wolf Light a perfectly distinctive character, a revolving dioptric light of the first order, showing alternate flashes of red and white at half-minute intervals, was resolved upon. This arrangement involved the consideration of the important question, which did not appear to have been previously determined with accuracy, of disposing in each beam the relative proportion of light to allow for the loss in the red beam by passing through a ruby glass medium, and produced at all distances at which the light could be seen, with variable states of the atmosphere, flashes of nearly the same strength. The investigation of the subject was entered into by Professor Tyndall, the scientific adviser of the Trinity House; and as it was one which could not be determined with accuracy by photometric measurements, he, with the author, paid a visit to the Rock Lighthouse, near Liverpool, which had a catoptric revolving light showing one red flash succeeded by two of white at intervals of one minute, and inquiries and observations were made on this light at the Point of Air Lighthouse, at a distance of 11¼ miles, and at the Great Ormes Head Lighthouse, at a distance of 30¼ miles. Experiments with red and white lights were also made in the experimental lighthouse of the Trinity House at Blackwall, and observations on these were taken from a station in Charlton, at a distance of 2 miles. From these practical tests it was determined that the quantity of light to be appropriated to the red beam *should* be to that of the white in the ratio of 5,275 to 2,250, or as 21 to 9 nearly. The apparatus had sixteen panels of refractors and lower prisms, and eight panels of upper prisms, to the circle. Eight panels of refractors and lower prisms of 18° each, were appropriated to eight beams of white light; and eight panels of refractors and lower prisms of 27° each, together with the eight panels of the upper prisms of 45° each, to eight beams of red light. The colour was produced by ruby glass placed in front of the panels, and revolving with the apparatus. The illuminating power of each beam sent from the apparatus was estimated at 2,250 French units.

QUEKETT MICROSCOPICAL CLUB.

The Annual Conversazione of this club took place at University College on Friday evening, and was attended by a very numerous assembly of members and visitors. The objects exhibited under the microscopes comprised specimens from nearly every branch of microscopical science, and evinced by their novelty an evident desire on the part of the members to cultivate every source likely to yield instruction. Amidst so much to attract attention, it is impossible to make a selection; we may therefore merely remark that amateurs and professionals were equally assiduous in contributing to the general entertainment of the company. In addition to the objects exhibited, an interesting collection of photographs, lent by the India Office, the Autotype Company, Mr. Shank, Mr. Good, and Mr. A. L. Henderson, were much admired. The whole process of micro-photography was demonstrated at frequent intervals by the Messrs. Solomon, the actinic influence being derived from their new magnesium lamp. Mr. Apps exhibited some large Gassiott's cascades and Geissler's tubes illuminated by his celebrated induction coil, and Mr. James How displayed Dr. Maddox's micro-photographs and some views of Swiss scenery, &c., by the aid of the oxy-hydrogen light. The meeting may be described as eminently successful.

RICHMOND AND NORTH RIDING NATURALISTS' FIELD CLUB.

The monthly meeting of this club was held in the museum, Castle-ill, on Tuesday, 8th inst., Mr. Wood, F.G.S., in the chair, who exhibited specimens of stone and flint weapons from Denmark, which he had purchased from Mr. Bryce Wright, the well-known London dealer. He stated they were amongst the finest examples of these curious

remains of ancient man obtained from that most prolific locality, and equal to any in the British Museum, or the fine collection of the Rev. Canon Greenwell; bones of the flying lizard (Pterodactyle), with a cast of the Mestrich specimen. These, with the drawings in the last volume of the Palæontographical Society, enabled the president to explain the nature of this most curious of all the creations of a former world. A fine specimen of the Old Red fish (Cheiracanthus), from Gordon Castle, a genus rendered classical by poor Hugh Miller, and its state of preservation and the length of its spines were objects of admiration. Roman silver and copper coins, a gift to the president from Mr. Young, late of the grammar-school. Mr. Barr sent a bronze stirrup of curious form, dug up at Bedale. The president said its age was uncertain, but he thought it was about the Marian period. Mr. John Metcalfe exhibited models in pottery of fawns' heads, of great beauty and life-like appearance. Mr. C. Walker, of Middleham, sent for presentation two ancient keys, dug up in that district. An explanation of their probable age and manufacture was given by Mr. John Metcalfe, after which an animated discussion on the subject followed. Ammonites from the lias of Whitby were also presented by the Rev. John Lawley.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, MARCH 7TH.—Amongst the correspondence of the day presented by M. Dumas was a paper relative to an earthquake which occurred at Ancona on the 8th of February.

Another communication was from the Peruvian Consul, stating that on the 7th of last December, at 7 a.m., and at 7 p.m. shocks of earthquake were felt in Peru, and were again repeated on the 28th.

M. Boussingault remarked, on this subject, that the volcano of "Copayan," after a long period of the most complete repose, had again become active. Is there a relation of cause to effect in these two phenomena? M. Boussingault was disposed to think so.

A letter from M. Lecoq de Boisbaudran described some needles of ice on a basin lined with cement, where their position could only be explained by an ascension of the water along the sides of the basin by virtue of capillary attraction. This fact is analogous to those already known with regard to the presence of icicles in plants, and is explained in the same manner.

A letter was received from M. Soret, describing some new experiments tending to show, contrary to the opinion of M. Lallemand, that the illumination of liquids contained in tubes through which a luminous bundle is passed, is caused by the presence of insoluble corpuscles, or at least that the illumination is in direct proportion to the quantity of the corpuscles. Pure water is not luminous, but if Indian ink is added to it, it becomes so. Thus nitrate of silver added to water containing chlorides, renders the water more luminous in proportion to the quantity of the chlorides.

M. Dumas observed with regard to this subject that M. Stas had already stated that the presence of chloride of silver is easily perceived by the passing of a luminous bundle through the liquid, and that he had pointed out this process as a means of adding to the sensibility of his apparatus.

A letter received from M. Houzeau recorded the complete absence of oxygenated water in snow collected recently by him at Rouen, and he believes himself in a position to affirm that if it exists at all it must be there in a proportion below the $\frac{1}{125000}$th part, for in introducing this minimum amongst the specimens submitted to his reagents, he has been able to recognize it distinctly.

A letter from M. Jonglet, civil engineer, contained some statements relative to the action of ozone upon explosive compounds, especially upon nitro-glycerine, those experiments tend to show a sudden deflagration of some of those substances.

General Morin mentioned that the experiments of MM. Pelouze et Payen show that gun-cotton, under certain circumstances, undergoes decomposition spontaneously, and detonates. To this must be attributed several accidents which have occurred at Bourget and Vincennes. When the temperature was raised to 50°, and sometimes even only to 40°, the pyroxylin detonated. This substance is very electric, and is often known to give off sparks when handled, or when placed in barrels to be transported from Paris to Bouchet.

M. Pouchet observed that for some time past it has been remarked at Rouen that the nests of the window-swallow are no longer constructed in the same way as heretofore; instead of a circular opening admitting a single individual, they present an elongated aperture in the form of a window, by which several may go in and out simultaneously.

A note taken from "a sealed packet," contained remarks on the striæ which are seen upon the Millstone Grit of Brie, from the presence of which the authors conclude that it belongs to the second period of the glacial epoch.

Among other communications were a memoir by M. Bonjean, of Chambéry, upon poisoning by cyanide of potassium and prussic acid; and also a note from M. Dubrunfaut on the spectra of rarefied gases.

ROYAL ACADEMY OF BELGIUM.

BRUSSELS, FEBRUARY 5TH.—The Minister of the Interior forwarded to the Academy an order for 23,750 francs, being the half of the annual grant to the Academy for the current year. The order was acknowledged by the treasurer, M. Stas. The Minister also sent a donation of various works, which were duly acknowledged in the *Bulletin*.

The Spanish Legation at Brussels, in the name of the Observatory of San-Fernano, at Cadiz, the Haarlem Society of Sciences, &c., presented various volumes of *Proceedings*.

The Institute of the Provinces of France announced that the 37th session of the Scientific Congress of France will take place at Moulins on the 1st of August next.

M. F. Terby, of Louvain, forwarded new observations on the Aurora borealis of the 3rd of January.

M. Michel sent a *résumé* of observations made at Ostend during the year 1869; and M. Cavalier, of Ostend, sent a series of similar observations for the month of January in 1870.

M. Ed. Lanszweert communicated an account of zoological observations made during the last year.

The following important memoirs were also received:—"On the Fishes which inhabit, and which accidentally visit, the coasts of Belgium, and on their Parasites," by M. P. J. van Beneden; "On the Earthquakes of 1868, with a Supplement recording those of the previous years from 1843 to 1867," by M. A. Perrey; "Researches on Friction," First Part, by M. J. M. de Tilley; "On the Meteoric Stone which fell at Saint-Denis Westrem, near Ghent, on the 7th of June, 1855," by M. S. Meunier; "Note on *Byrsax gibbifer* (Wesmael de Java)," by M. A. Preudhomme de Borre; "Foundation of a Higher Cartesian Geometry," by M. F. Folie; and lastly, "Notice on Bryonicine," by MM. De Konninck et Marquart.

VIENNA ACADEMY.

FEBRUARY 3RD.—In the absence of the president, Professor J. Redtenbacher presided. The secretary placed before the meeting the following papers:—On Dye-compounds from Madder, by Professor Rochleder, of Prague.

On Duallistic Functions, and On the Electric Current which appears in connection with Endosmose, both by Professor Miller-Haumfels, of the Royal Berg-Academy, Leoben.

The Society of Naturalists at Riga sent invitations for the 25th anniversary of its establishment.

Dr. Leopold Fitzinger sent in the second and concluding part of his memoir on the Horse-shoe Bats (Rhinolophi). The genera Rhinolophus, Ariteus, Aquias, and Rhinonycteris were dealt with.

Professor Redtenbacher read a communication from Professor H. Will, of Giessen, on the chemical constitution of white mustard-seed. Differing from black mustard-seed, which contains myronate of potassium, the white contains an analogous compound, sinalbin, which appears to resolve itself into sugar, a sulpho-cyanogen compound, and an acid sulphate salt. The sulpho-cyanogen compound is involatile, and contains an oxygen-radical, Akrinyl (C_7H_7O). In the acid sulphate referred to, the potassium base is replaced by sinapisin. The following scheme explains the relation of their bodies:—

Myronate of potash.	Sugar.	Sinapin. (*Senföl.*)	Potassic sulphate.
$C_{10}H_{19}NS_2KO_{10}$	$C_6H_{12}O_6 + C_4H_5NS$	+	SO_4KH.

Sinalbin.	Sugar.	Sulpho-cyanogen compound of Akrinyl.	Acid sulphate of sinapisin.
$C_{30}H_{44}N_2S_2O_{16}$	$C_6H_{12}O_6 + C_8H_7NOS$	+	$SO_4(C_{16}H_{14}NO_5)H$.

The sulpho-cyanogen compound of akrinyl deprived of its sulphur, and when in the state of nitryl added to an alkali, gives ammonia and the salt of an acid = $C_8H_8O_3$, which at 136° melts, and is indentical with no acid which is known.

NOTES AND MEMORANDA.

The British Journal of Photography's Prize to Photographers' Assistants.—The *British Journal* has done a good thing in offering a prize of this kind. The prize, which is for the best essay on any subject of practical interest to photographers, written by any one belonging to this class, will assume the shape of a complete set of apparatus for *carte* pictures, to be supplied by first-class London makers; and it is to be distinctly understood that photographers' assistants only are invited to compete for the prize. All competitive

communications must be sent, addressed to the editors, on or before the last day of April, and each paper be signed with a *nom de plume* or cipher, a sealed envelope containing the name and address of the writer to accompany each communication. Every competitor should understand—first, that in no case whatever will the names of *unsuccessful* candidates be made known; secondly, that although the prize is for the *best* essay, the publisher will recognise all other deserving communications by prizes in a pecuniary or other form, all these being published in the *Journal*, with the names and addresses of the authors; thirdly, that originality in the method of treating the topics selected will be considered of more importance than mere literary excellence. Essays selected for publication will, where necessary, be remitted to the authors for correction in the style of composition. The subject selected must be one of practical interest to photographers. This, it will be observed, does not exclude a merely theoretical disquisition, if it be one that will conduce to practical knowledge.

The Geology of Alaska.—The *American Naturalist* thinks that the most interesting results of Mr. Dall's recent explorations are the determination of the facts that west of the 105th degree of longitude the Alaskan coast is rising, that the former violence of volcanic forces is diminishing throughout the territory, and that there are no evidences of general glacial action. Mr. Dall has travelled thirteen hundred miles up the valley of the Yukon, and explored on the shores of Norton Sound, without obtaining any evidences of glacial action. The whole territory north of the Alaskan Mountains could not, therefore, have been covered by the same general sheet of ice which has scratched the section east of the Rocky Mountains. This raises an unexpected obstacle in the path both of the hypothesis of a general terrestrial glacial sheet, and the theory of floating ice. In either case it will be difficult to explain the absence of scratches on the northern slope of the Alaskan Mountains when all the rest of North-eastern America must have been covered with ice. If Alaska were covered by the waters of the Pacific, why did not the floating icebergs score the surface, and if it was out of water during the glacial epoch, why did not the great terrestrial glacier of the east have its counterpart in the Arctic valley of the Yukon?

Improvements in Mining Machinery.—A Mr. King, of Derbyshire, is engaged on improvements in the machinery for the descent and ascent of coal-mine shafts, with a view to the prevention of accidents.

SCIENTIFIC DIARY.

WEDNESDAY, March 16th.

Society of Arts, 8 p.m. "On Surface Decoration," by William Pitman, Esq.
Philosophical Society of Glasgow, Sanitary Section, 8 p.m. The debate "On the Licensing System" will be read by Mr Thomas Dick, and brought to a close; Mr. Melvin being allowed half an hour to reply.
Meteorological Society, 7 p.m. "Daily Rainfall, 1815–1869," by Mr. J. Glaisher. "Rainfall of Natal, South Africa," by Dr. Mann.

THURSDAY, 17th.

Royal Society, 8.30 p.m. "On the Law which Regulates the Relative Magnitude of the Areas of the Four Orifices of the Heart," by Dr. Herbert Davies. "On the Estimation of Ammonia in Atmospheric Air," by H. T. Brown.
Society of Antiquaries, 8.30 p.m. "On Ancient Round Barrows," by Dr. Thurnam.
Linnean Society, 8 p.m. "On the Flora and Fauna of Round Island, Mauritius," by Sir H. Barkly. "On the Algæ in the North Atlantic Ocean," by Dr. Dickie.
Zoological Society, 4 p.m.
Chemical Society, 8 p.m. "On Artificial Alizarin," by Mr. W. H. Perkin. "On Combinations of Carbonic Acid with Ammonia and Water," by Dr. Divers.
Numismatic Society, 7 p.m.
Royal Society Club, 6 p.m.
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.
Harveian Society of London, 8 p.m. "On Cirrhosis of the Lung," by Dr. C. Handfield Jones.
Bradford Philosophical Society, 8.15 p.m. "The Suez Canal," by Edward Dicey, Esq., M.A.

FRIDAY, 18th.

Philogical Society, 8.15 p.m. "On Sanskrit Numerals," by Professor Goldstücker.
Royal Institution, 8 p.m. "On the Subway to France," by Mr. J. F. Bateman.
Medical Teachers' Association, 8 p.m.

SATURDAY, 19th.

Royal Institution, 3 p.m. "On the Sun," by Mr. Lockyer.
Association of Medical Officers of Health.

MONDAY, 21st.

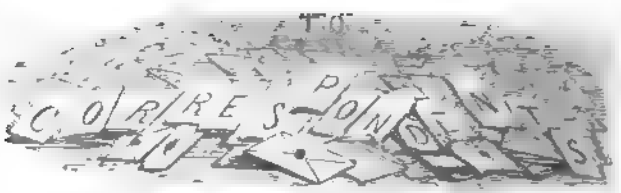
Entomological Society, 7 p.m.
Medical Society of London, 8 p.m.
Asiatic Society, 8 p.m.
Victoria Institute, 8 p.m.
London Institution, 4 p.m.
National Association for the Promotion of Social Science, 8 p.m. "On the Practicability of Collecting and Publishing National Returns of Sickness at frequent Intervals," by James Lewis, Esq.

TUESDAY, 22nd.

Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m.
Ethnological Society, 8 p.m. "On Current British Mythology, and on Oral Tradition," by Mr. Campbell, of Islay.
Manchester Literary and Philosophical Society, 7 p.m.
Royal Institution, 3 p.m. "Nervous System," by Professor Oliver.

WEDNESDAY, 23rd.

Society of Arts, 8 p.m. "On State Railways for India," by W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.
Geological Society, 8 p.m.
Royal Society of Literature, 8.30 p.m.
Archæological Association, 8 p.m.



GEOLOGICAL GRANTS.—"W. K."—Both communications have reached us. The question you put is one for the publishers. We fear the latter, owing to the number of applications, are averse to the proposal.

MICROSCOPIC FUNGI.—"M. C. C."—The notice has been received, as you will see. Send us a report of the meeting for insertion. Will the question of Cholera-fungi (!) be gone into?

DR. TYNDALL'S RESEARCHES.—We fear we cannot oblige our correspondent. People should not write letters which they wish to withdraw; it is absurd, not to say inconsiderate. The communication was in type when your second letter arrived.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.—"T. W. W."—Thanks for the report.

UNITED STATES NAVAL OBSERVATORY.—"B. F. S."—We beg to express our thanks to the superintendent for the valuable reports which he has forwarded, and which shall be fully reviewed in due course.

PHOTOGRAPHS OF THE SUN.—"C. H. C."—Our best thanks are due for the beautiful photographs of the late solar eclipse which the Surgeon-General of the United States Army has just sent us. They shall be noticed.

AERATED WATER.—"G. C."—The operation is generally performed by machinery. The flask is placed in a sort of case.

DEPTH OF A PHOTOGRAPHIC LENS.—"A. C. D."—In some measure the best test is experiment. Certain formulæ may also be used, given the density and curvature of the glass. Consult Monckhöven's manual, published by Hardwicke.

THE NOVEMBER METEOR THEORY.—"A. E."—We are sorry we cannot reproduce your paper. It is now too late. If you send us any letter to your opponent, Mr. P., we shall forward it for you.

SOCIÉTÉ IMPÉRIALE ZOOLOGIQUE D'ACCLIMATATION.—M. Soubeiran is heartily thanked for his most courteous and complimentary letter. We will lay his proposal before our publishers. The number of the *Bulletin* sent was that for January.

THE ELECTRIC VANE.—"J. E. H. G."—We return the copy of the paper sent. We regret that, under the circumstances mentioned in your note, we cannot reproduce the account, which would be useless without the blocks.

BARLERIA.—"T. M. M."—Unfortunately, illness at the time prevented our seeing your letter. It must have been through some oversight of our "sub," that the notice was omitted. He has no recollection of seeing any such comments as those you mention. If not too late, why not write us a short letter on the subject? We shall be happy to publish it.

THE SENSE OF SMELL.—"Smells and Smells." Too late for insertion.

TAYLOR'S "NEW ZEALAND."—Messrs. Macintosh are thanked for their kindness.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, MARCH 23, 1870.

OPENING THE BRITISH MUSEUM AT NIGHT.

THE meeting which was last week held in the Town Hall, Shoreditch, was but the expression on behalf of one section of the community of a feeling which is very largely shared by all—viz., that the public should have some greater return for their money than that which is now offered to them by some of those institutions for whose support they pay so dearly. And the Chairman of the meeting, Mr. John Holms, M.P., did not put the matter too strongly when he placed in the opposite scales of the balance the £113,000 a year which the British Museum receives from the country and the benefits which the Museum in return offers to the nation. Might he not, indeed, have gone very much further? Might he not have asked what is done by the huge scientific staff of the British Museum to enlighten the public on the advances which Science is making in England and all over the world? And if such a demand were made, how would that little colony of public Scientific servants, who are provided for and lodged and fed with the most nutritious pabulum of research, have made answer to the nation? Verily, we know not!

The small mite of reform which the meeting at Shoreditch seeks is one of the most reasonable that can be conceived. Bear in mind, it does not for a moment demand that the British Museum shall be educational. It does not ask that the country shall learn anything from the monster collection in Bloomsbury. A long and perhaps painful experience of the utter hopelessness of obtaining anything save "confusion of ideas" from the interminable galleries of the British Museum has taught it the absurdity of such a proposal. It merely asks that the vast "old curiosity shop" of the nation shall be thrown open to the masses during a reasonable period of the evening, and who can gainsay so modest a request? We should certainly not oppose it. It is but the merest fragment of justice to that great over-taxed population whose life, as Mr. Mantalini would have said, is one "perpetual grind," and who get so little out of the money they give towards the encouragement of "Science and Art." We earnestly trust, then, that the members of the House will not be earwigged by any of the "shoulder-tappers" of officialism, but will view the question in the broad, fair light in which it should be examined, and will at once confer on the people the very small and undeniable boon which they so urgently demand, and which is so unquestionably their due. It will be monstrously wrong if any absurd objection about extra attendants or dangers of gaslight be allowed to stand in the way. If the country thinks it worth its while to give £113,000 to support a National Collection, it can and should afford the miserably small extra amount required for gas-lighting and attendance during the hours when the mechanic can at his leisure wander through its galleries.

What we wonder at is, that some of those who are so anxious to open the British Museum to the British workman did not bethink them whether a trip to the Museum could do anything more than bewilder the intelligent artisan. It does seem a little surprising, to those who know how the National Collection is at present arranged, that any body of intelligent workmen could delude themselves by the notion that a visit to the big house in Great Russell-street could teach them anything profitable. For, in our humble judgment, a worse arranged, or, in an educational point of view, more useless accumulation of costly curiosities is not to be found in any city of Europe. Not only are the specimens—whether they be in the Natural History or the Antiquities department—huddled together in the most intricate form of higgledy-piggledy, but in many cases it is impossible to read the labels bearing their names, and in no case is the least attempt made to convey anything of principles or laws beyond the bare fact of the specimen itself. And we ask any rational person, what is even a thinking workman to learn, in what respect is he improved, even to his small proportion of the £113,000 a year, by being informed that a huge head is that of Rameses, or that a number of split flints are from the cave of Bruniquel (these cost some £2,000); or, as sometimes happens, by being told nothing at all about a giant sarcophagus covered with hieroglyphics? The thing is so ridiculous that our astonishment increases each year to find that nothing is done to rouse the Museum superintendents from the Rip Van Winkle sleep into which they seem to have fallen.

What is the reason of all this, and who is to blame? These are questions we do not care to answer just now. Years ago Dr. John Edward Gray made an attempt to instil practical ideas into the minds of his *confrères*, and, we believe, even went so far as to draw out a plan for making the Museum a place where the public might learn something; but nothing came of it, and here we are in this year of grace with a collection worth millions, costing the country over a hundred thousand a year, and yet of no use whatever to the general public. Surely, this state of things is not to be permitted to remain! The nation will not much longer be content to support a costly staff of scientific men whose labours are spent nearly entirely in advancing Science among scientific men, but who do not think it worth their while to give even a tithe of their time to the instruction and improvement of that great population whose little hard-earned incomes are taxed to give the British Museum staff the opportunity of pursuing their scientific hobbies to the best advantage.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

THE Geologists' Association, under the direction of the president, Professor Morris, will pay a visit to the British Museum this afternoon. Members and their friends will meet in the entrance-hall at 2 p.m. Under the chaperonage of so old and thoroughly practical a geologist, and so pleasant a companion, as Professor Morris, the members may expect great profit and enjoyment from their visit.

AT the meeting of the Literary and Philosophical Society of Manchester last evening, Mr. R. D. Darbishire, F.G.S., exhibited specimens of electroplate reproductions of some of the Roman plate lately found at Hildesheim, and gave a summary of Mr. Wieseler's discussion upon this find.

PROFESSOR OLIVER continues his lectures on Botany to the ladies' class at South Kensington. The treatment of his subject is very much the same as that adopted in his excellent little manual in the Clarendon Press series. Following the Schedule scheme proposed by the late Professor Henslow, and fully described some years ago by the Rev. G. Henslow in the *Popular Science Review*, Professor Oliver provides each of his pupils with a printed form, in which the characters (technically) of the plants selected are to be filled in. The plan works well, and we advise those of our lady readers who have not yet entered the course to do so without delay.

IN further developing the idea of Lectures on Science for Women, the authorities of the Science and Art Department have arranged with Mr. Sullivan for the delivery of a course on

the Science and Practice of Music. This course will be commenced shortly after the termination of Professor Oliver's lectures, and will, as part of its plan, include a class for "part-singing."

M. Charles Clermont-Ganneau announces in the *Times* the discovery of a stone slab bearing a Phœnician inscription, and found near the Dead Sea in the land inhabited by the Moabites of Scripture. The inscription commences with these words, "I, Mesa, Son of Chamos." Now Mesa was a king of Moab mentioned in the Bible, and was the contemporary of Elisha, of Josaphat, Achab, Ochozias, and Joram. It is curious that the Moabite stone just found records the campaign of Mesa against the King of Israel which is detailed also in the 2nd Book of Kings. This is but one of a host of most interesting discoveries which we may look forward to as the result of the explorations of the Palestine Expedition.

Professor Louis Agassiz, the Director of the Museum of Comparative Anatomy of Cambridge, U.S., has issued a brief circular to the Natural History world which we trust will receive the attention of all zoologists who have surplus collections. Professor Agassiz states that the Museum of Comparative Zoology is particularly desirous to enlarge its collections of mammalia. With the exception of the American species, which are largely represented, it possesses few mammalia; even the European types are still scantily exhibited upon the shelves. The Director would prefer to receive well-mounted specimens of the larger species, well-prepared skins and alcoholic specimens of the smaller ones, and skeletons, or at least skulls, of all. He wants, as far as possible, a complete series of specimens of each species, including several males, females, and young in every stage of growth and colour. Books on mammalia would be equally valued. In exchange for them the Museum offers representatives of the North American faunæ and American books. Correspondents should address the Professor at the Museum, as above.

Captain Swann, the present proprietor of Redhill Observatory, wishes to part with the dome, which was put up by Mr. Carrington at an expense of more than £150. He will sell it at a great reduction; it is in as good condition as when first erected. It is of iron throughout, 25 ft. diameter.

Dr. T. Spencer Cobbold, F.R.S., who is the present Swiney lecturer in Geology, is now delivering part of his course in the London Institution. The lectures will be continued every Thursday, at half-past seven in the evening, until June 2nd inclusive. It is proposed to discuss, among other subjects, Method of Geology and Palæontology (subject for to-morrow evening); Significance of the Facts of Succession and Superposition; the best mode of acquiring an adequate conception of Geologic Time; Determination of the Earliest Representatives of Animal and Vegetable Classes; General Account of the past record and range of the more important major Animal Groups; Known Range in time of the Organic Series as a whole; Parallelism subsisting between the Group-record of the Animal and Vegetable Kingdom respectively; the Claims of Geology as an aid to the acquirement of high Mental Culture. The lectures are open free to the public.

Mr. Carrington, the well-known astronomer, is now engaged in erecting a new observatory at Churt, near Farnham. This observatory is arranged on a new plan of construction. As it is situated on a conical hill, entirely detached, and 60 ft. high, no elevation of the building is needed. Mr. Carrington has sunk the observatory below ground, so that the instruments can just be directed over the soil at the top of the mound. There has been sunk a dry well, 6 ft. in diameter, to a depth of 40 ft., in which a clock, placed in an air-tight case, may be kept at a position of invariable temperature and at a constant and diminished pressure. The observatory will be furnished with an Altazimuth on Steinheil's principle, in which the horizontal axis is also the optical axis; an object-glass of 6 in., provided with a prism fixed outside it, is placed at one end, and the eye-piece at the other end of the axis.

It is stated in the *Philadelphia Photographer* that Mr. Rutherfurd has lately photographed successfully the star group of the "Pleiades." He has measured them micrometrically, and found his measurements to correspond with those of the celebrated Berrel. Mr. Berrel was employed for eleven years in his measurements; Mr. Rutherfurd accomplished them in one night.

We last week announced the death of the celebrated Austrian chemist, Herr Dr. Joseph Redtenbacher. Herr Redtenbacher was professor of chemistry at the University of Vienna. The deceased was born on March 12th, 1810, at Kirchdorff (Austria), and since 1849 held this chair. He was well known as the author of a large number of scientific memoirs and papers, and was a member of the Imperial and Royal Academy of Vienna from the date of its foundation, some forty years ago.

Telegraphs, railways, and huge ocean steamers are every day removing the old barriers of nationalities. Nowadays the connection in Arts and Sciences between this country and "the States" is almost as close as it was between England and Ireland twenty years since. The National Photographic Association of the United States is an illustration of this. This association is to hold its annual exhibition at Cleveland, Ohio, commencing on June 7, 1870. Photographers in this country are cordially invited to contribute. It is requested that those who desire their pictures to be sold should send by mail two detailed invoices; also stating particulars, as to date of shipment, name of steamer, &c. Packages should be addressed "National Photographic Exhibition, care of Edward L. Wilson, Secretary, Philadelphia, U.S.A. (*viâ* steamer to Boston)," and should be sent not later than April 20th. The Cunard steamers sail from Liverpool for Boston every Tuesday, and those of the Inman line every alternate Saturday.

The gold-bearing rocks of Nova Scotia are undergoing careful examination. A preliminary report has just been made by Professor Hind, upon the rocks supposed by him to represent the great Laurentian system of Sir W. Logan. Professor Hind, says the *Mining Journal*, considers these rocks to consist of sedimentary deposits, altered by metamorphic action, and that their crystalline structure was produced before the deposition of the gold-bearing rocks which lie unconformably upon them. Gold is found and worked in the Laurentian rocks in Canada, as at the Madoc Mines, and it is not improbable that mines may yet be opened in the Laurentian of Nova Scotia. The area occupied by the Laurentian in Nova Scotia is, probably not less than one-half that part of the country which has hitherto been represented on geological maps as Lower Silurian. The Laurentian, being auriferous inferentially, may yet turn out to be as valuable in mineral wealth as the Silurian deposits now worked. In Canada, there are, besides gold, beds of magnetic iron ore, of sulphurets of iron and copper, and of titaniferous iron ore in these rocks, which may also be found in the Laurentian of Nova Scotia, and being in close proximity to the coal-fields, may yet prove a great source of wealth.

Last week an important meeting of the inhabitants of the East of London was held in the Town-hall, Shoreditch, for the purpose of adopting resolutions favourable to the opening of the British Museum on certain evenings during the week. Mr. John Holms, M.P., who occupied the chair, in opening the proceedings, said the object of the meeting was to aid the motion of Mr. Allen, which would be proposed next week, should the state of public business permit, that the British Museum be opened to the public three nights in each week, and that a better use might be made of the national institution of the metropolis. They would not be asking too much were they to insist on the British Museum being opened five days in the week, and especially on the Saturday evening.

He could not see why an institution of national importance, which cost annually £113,000 for its maintenance, should not be thrown open to the public. As a proof of the interest which they evinced in visiting the institution, it was found that the attendance on Monday was always larger than on any other day, and Easter and Whit Monday brought crowds of visitors. It was stated before the Commission by one of the superintendents that working men formed interesting collections of natural history for themselves, and within a range of a few miles of the Museum there were between 200 and 300 private collections. They might hope to see before long a higher technical education for the people, which would make them take a deeper interest in museums were they thrown open to them. They had a great advantage over the other countries of the Continent, and that was in having shortened the hours of labour; but it would be well that the working men should utilize these hours. Mr. Hall moved the first resolution—"That this meeting hopes that her Majesty's Government and all members of Parliament will support Mr. W. S. Allen's motion in the House of Commons for opening the Museums three week-day evenings in each week, from seven to ten o'clock;" which was seconded by Mr. Richard, supported by the Rev. Mr. M'Caul, and unanimously agreed to.

The Executive Committee of the General Medical Council was received on Wednesday last by the Lord President of the Privy Council, on the subject of the Amendment of the Medical Acts. The Committee consisted of Dr. Paget (President), Dr. R. Bennett, Mr. Cæsar Hawkins, Dr. Acland, Dr. Andrew Wood, Dr. A. Smith, and Dr. Sharpey. The details of the interview have not been published; but it is probable that a second interview between his Lordship and the Committee will take place very shortly.

At the last meeting of the Photographic Society of France a curious communication was presented by M. George Poirée, upon methods for obtaining photographs of images in which the effect of relief shall be true, or not false, as is the case generally. For instance, if a photograph of a white statue, one side of which is in shade, be taken upon a gelatine plate, it will be found on development that the side in shadow is represented by a depression in the gelatine, whereas, *in reality*, the side in shade is as round and as much in relief as the other. The plans proposed to overcome this were to cover the objects with lampblack, illuminate them equally, or to place them in a non-actinic liquid. The Paris correspondent of the *British Journal of Photography* thinks the communication was considered as more theoretically curious than practically useful.

The French police have interdicted the sale of paper coloured green by arsenic. At least, they have issued a circular stating that in case of injury from use of such paper, the manufacturer will be liable to prosecution. A similar step might be taken here with advantage.

The *British Journal of Photography* has received from Mr. M. Carey Lea some photographs in illustration of the chlorobromide and collodio-bromide processes. Two of the prints by the latter process are very soft and delicate, one of them being a charming rustic lane scene, and the other a view on the banks of what has the appearance of a sequestered river.

Two very interesting and important memoirs were brought before the Chemical Society on Thursday last. One was by Mr. Perkin, the Secretary, on Artificial Alizarine. Mr. Perkin gave a clear sketch of the purely theoretical process of reasoning which led to the discovery of this substance. He then, by means of the electric lamp, showed the absorption spectra of the natural (madder) and artificial alizarine, and finally exhibited a great number of stuffs dyed with the two compounds, and some of which had been for months exposed to the sunshine. It was impossible to distinguish between the two sets, those dyed with the natural and those with the artificial substance. The other paper was by Dr. Edward Divers (lecturer on toxicology at Middlesex Hospital), and dealt with the author's recent researches into the constitution of the ammonia carbonate and carbamate. Dr. Divers's paper was not concluded last evening, and its further reading will take place at the next meeting, when we believe that some of the author's ideas are likely to be disputed.

Photographic Æsthetics is, says the *Photographic News*, the subject of a work which Dr. Vogel has now in hand.

Mr. Darwin is working away vigorously at his great work on Man.

The Hyacinth Show of the Royal Horticultural Society, last week, was a great success. The exhibition was continued up to to-day.

A new Dictionary of Science, or rather of Physics, is about to be issued by Messrs. Moxon. The work will be edited by Mr. G. F. Rodwell, whose interesting articles on the History of Pneumatics appeared some time ago in the *Chemical News*. It will be uniform with Haydn's *Dictionary of Dates* and *Dictionary of Biography*, and will comprise—Acoustics, Astronomy, Chemistry, Dynamics, Electricity, Heat, Hydrodynamics, Hydrostatics, Light, Magnetism, Meteorology, Pneumatics, Statics. These subjects will be treated of by—J. T. Bottomley, M.A., Lecturer on Natural Science in King's College School; William Crookes, F.R.S., &c.; Frederick Guthrie, B.A., Ph.D., Professor of Natural Philosophy in the Royal School of Mines; R. A. Proctor, B.A., F.R.A.S.; Richard Wormell, B.A.; and the editor.

The *Athenæum* records the following important experiment made by Sir Thomas Maclear:—I built (he says) two pillars of solid masonry, and sheltered them at a locality on the line. Each carried a micrometer microscope. With these I compared the relation between the expansion of the standard iron-bar and the indications of the two thermometers with oblong bulbs sunk in holes in the bar and surrounded with oil, and observed in the accidental temperature of the atmosphere, at short intervals, throughout twenty-four hours, night and day. The expansion of the bar in ascending temperatures, and contraction in descending temperatures, were about two hours behind the indications of the thermometer. To this circumstance is owing in part the rough results of comparisons in the field between the standard iron-bar and the compensation-bars.

The Central Horticultural Society will erect a monument to the late Mr. S. Broome, gardener to the Inner Temple.

Just as we went to press last Tuesday, a deputation of members of the medical profession had an interview with the Home Secretary, on the subject of the necessity for some legislative enactment for the better construction of dwelling-houses, especially for the labouring classes. The deputation consisted of Dr. Aldis, Dr. J. N. Vinen, Dr. Stephenson, Dr. Tripe, Dr. Woodforde, Dr. Ballard, Dr. Rygate, and Mr. Liddle.

The Royal Danish Society of Science, among other prizes, has offered one amounting to £34 for the best essay containing an investigation of the movement of the air in a system of ventilation. The essay may be written in English, French, German, Danish, or Swedish, and must be handed in before October, 1870.

The Society of Arts' conversazione is fixed to take place at the South Kensington Museum on Wednesday morning, the 27th of April. Cards will be issued shortly.

We understand that experiments have been recently made at Toulon to try to attach to life-buoys another floating body provided with phosphide of calcium, which, on becoming wet, gives off spontaneously combustible phosphuretted hydrogen, thus emitting light to guide the man who might have fallen overboard, and be in search of the life-buoy.

By the death of Mr. William Gibbs, which took place at Faversham, on the 28th of February, the South Kensington

Museum acquires the collection of Roman and Anglo-Saxon antiquities in the possession of that gentleman.

The female doctor mania has not yet abated. We now learn that Miss Morgan, who studied for a short time at several of the metropolitan medical schools, has just graduated with distinction in medicine, surgery, and midwifery, in the University of Zurich.

The marbles sent over from Priene a short time ago by Mr. Pullan to the Dilettanti Society, have been presented by that society to the nation, and are now housed in the British Museum.

The Society of Arts is becoming very energetic, but energy is not sufficient. For example, as we pointed out last year, we should like to see the labours of its food committee conducted a little more scientifically. The mere fact that a number of gentlemen open a lot of tins of preserved meat and pronounce the contents excellent is not exactly what hygienists require. The following account of the last meeting will show what we mean:—The Committee had before them specimens of American salted beef, as purchased for her Majesty's navy, and also specimens of English meat salted for the navy in Deptford Victualling Yard, both specimens being furnished by Mr. Brady. They had also before them soup made from the desiccated Queensland beef, referred to at the former meeting of the committee. Also a tin of preserved mutton from Australia, sent by Messrs. Kalterman & Schmitz, from the Ballarat Meat Preserving Company. The navy beef was pronounced excellent, there being hardly any perceptible difference in the qualities of the two specimens, though the majority of the committee was of opinion that the American meat was superior to the English. The soup prepared from the desiccated meat, with the addition of a small quantity of vegetables, was considered very successful, and the committee are of opinion that meat so preserved is likely to prove a valuable and cheap addition to the food resources of the people. The specimen from which the soup was made had been in the Society's possession, and formed part of the contents of a tin opened upwards of two years ago. The preservation was perfect.

Dr. Sibson will commence his Croonian lectures on Aneurism of the Aorta at the College of Physicians this afternoon. They will be continued on Friday and Wednesday next.

A new medical society has just been founded at Washington, U.S. It is a special part of its plan to admit both niggers and women as members.

It is being attempted by some of the American States to bring in a law similar to that now prevailing in parts of Germany, to compel butchers to examine pork with the microscope previous to offering it for sale. This has resulted from the fact that numerous cases of trichiniasis have lately occurred in Illinois.

The grant of £400 hitherto annually given to the Botanical Museum at Glasnevin, Dublin, has not been passed in the Civil Service estimate for the current year. We may have more to say of this anon.

A flag for the national Capitol has been made in California of silk produced in the State, and it will soon be sent to Washington.

The Police Commissioners of Glasgow have voted the sum of £100 towards defraying the expenses of the British Association Sewage Committee. The fund already amounts to upwards of £1,000.

The following quotation from an American medical journal shows us how much pedantry still exists in the profession:—"Professor J. D. Rankin, of the Galveston Medical College (*Galveston Medical Journal*), objects to the classification of malarious fevers into '*intermittent, remittent, and congestive*,' on the ground that these titles are not sufficiently expressive of the morbid conditions; he therefore proposes the simpler and more intelligible names: 'Passive hemato-neuro-endangitis gravis! Hemato-neuro-endangitis gravior!! and Hemato-neuro-endangitis gravisimos!!!'" It is the characteristic of true genius to simplify all it touches.

The French International dog-show opened yesterday.

The Report of the last meeting of the British Association has been issued to the subscribers, and is full of valuable matter.

At a recent meeting of the College of Pharmacy of the City of New York, Mr. Henry Deane, F.L.S., Mr. Daniel Hanbury, F.R.S., and Professor Attfield, F.C.S., were elected honorary members.

According to Mr. A. Somervail's recent researches, published by the Geological Society of Edinburgh the least depth of the Carboniferous Sea was about 50 fathoms, and its greatest depth 1,000.

It is rumoured that Professor Wyman has discovered a crocodile in Florida!

The Chancellor, Vice-Chancellor, and Fellows of the University of London have memorialized the Queen, praying that her Majesty will decline to approve that portion of the statutes framed by the Commissioners for the government of the schools of Winchester, Harrow, Charterhouse, and Rugby, which provides that the person to be nominated by the Senate of the University of London as a member of the new governing bodies of those schools shall be a member of the Church of England.

The Committee of the Athenæum Club, which has the power of electing a certain number of distinguished men as members, without submitting them to the ordeal of being posted up for several years, elected at their last meeting General Boxer, A.R.A., F.R.S., late Superintendent of the Royal Laboratories.

WHAT WAS DONE IN THE SEVERAL BRITISH OBSERVATORIES IN 1869.

BY PROFESSOR ADAMS, F.R.S., V.P.R.A.S.

In Four Parts.—Part I.

Royal Observatory, Greenwich.

THE chief special work which has occupied the attention of the Astronomical Department of the Royal Observatory during the past year has been the preparation of the new Seven-year Catalogues of Stars for 1864, good progress of which has already been reported. The calculations are now completely finished, and about one-third of the Catalogue is printed; the whole work being intended to form an appendix to the *Greenwich Observations* for 1868. We believe that its publication will be a great boon to all practical astronomers, especially as the Catalogue contains a large number of stars which have not before been observed at Greenwich since the time of Bradley.

Although the preparation and the reading of the proof sheets of the new Seven-year Catalogue have formed the chief additional work of the Royal Observatory during the past year, absorbing necessarily a considerable portion of the computing strength, yet the ordinary observations and computations have not suffered seriously. The sun, moon, the principal planets, the minor planets in the first half of the lunation, the necessary stars for the determination of the clock and instrumental errors, with others whose places are required for special purposes, have all been observed with the transit-circle

with the utmost regularity. Observations of the moon and of the stars and collimator have also been daily made with the altazimuth when practicable.

The printing of the astronomical part of the volume for 1868 is in a very forward state, and the reduction of the observations made in 1869 is so far advanced that a considerable portion of the results is nearly ready for the printer.

The volume for 1868 will contain three appendices:—1. Mr. Breen's paper "On the Corrections of Bouvard's Elements of the Orbits of Jupiter and Saturn." 2. The Greenwich Seven-year Catalogue for 1864. 3. A Description, with Plans, of the Great Equatoreal.

Royal Observatory, Edinburgh.—The observations of fifty-five stations of the Meteorological Society of Scotland have been computed here during the last year, and published by the Registrar-General in Scotland. Time-signals by gun and ball have been daily given. Meridian observations of stars with the transit instrument and mural circle have been carried on, but not to the full extent, on account of the reduction of past observations having been taken up. A *Report to the Board of Visitors* appointed by Government was published last May, and refers to several matters of exceptional interest.

Radcliffe Observatory, Oxford.—The principal change during the past year to be noted with regard to this Observatory is in its personal staff, arising from the death of the first assistant, Mr. A. Quirling. Mr. Quirling had been suffering from severe illness for several months before his death, which occurred on the morning of the 8th of June last. The vacancy which occurred in the establishment on this account, has been filled up by the appointment of Mr. Lucas to be the principal assistant, and by the engagement of Mr. S. Béchaux, B.A., of Sidney Sussex College, Cambridge.

Mr. Béchaux took first-class mathematical honours in the year 1861, and the energy and zeal with which he has devoted himself to the active duties of astronomy since his connection with the observatory, have been already productive of the happiest effects.

The illness and death of Mr. Quirling, of course, produced some derangement in the business of the establishment, but not to so great an amount as might have been anticipated, as will be shown by the work which has been accomplished during the last year.

It may be mentioned, in the first place, that the volume of the Radcliffe observations for 1866, was published last mid-summer, and that the astronomical portion of the volume for 1867 is nearly completed, some copies of the *Catalogue of Stars* (1,477 in number) for that year having been circulated amongst astronomers.

The reductions of the observations for 1868 are nearly completed. The meridional observations for that year include a catalogue of about 1,700 stars, 114 observations of the sun, 63 of the moon, 27 of Mercury, and 18 of Venus. Seven occultations of stars by the moon were made and reduced, and the heliometer was used when the weather permitted for the observations of double stars.

For the year 1869, the transits are thoroughly reduced and ready to be made into ledgers for the formation of a catalogue of stars, in number about 1,400, but only the first steps of the reduction of the North Polar distances have been performed. The number of meridional observations made during the year is quite equal to the average, the number of transits being about 3,000, and of zenith distances about 4,000. The usual quantity of extra-meridional work was also done in the year.

The photographic meteorology has been carried on by Mr. Lucas with the same success as heretofore, and the reductions for 1867 are nearly completed.

But the most remarkable work which has been completed during the year is the *Second Radcliffe Catalogue of Stars*, which has very recently been finished, and some copies distributed amongst astronomers. As this catalogue will have a separate notice in the general review of astronomy for the past year, it will be sufficient in this place to say that it contains 2,386 stars observed between the years 1854 and 1861, both inclusive.—*Annual Address to the Royal Astronomical Society.*

EXPERIMENTS ON THE HEAD OF A GUILLOTINED PATIENT.

T the time Troppmann was beheaded, a medical man in Paris, Dr. Pinel, made the startling announcement in one of the political journals that death by the guillotine was the most cruel of all, as, through the suddenness of the process, life remained in the head of the criminal at least *one hour* after the execution. This statement was supported by physiological notions peculiar to the author; but, notwithstanding their heterodoxy, they may have been brought forward without any blame attaching to M. Pinel, had not he adopted the curious proceeding of publishing his note in a political journal instead of a professional one. At all events, the note produced the desired effect. The public mind was deeply moved, and a host of extraordinary histories went the round of the journals. Such sensational stories as Heindrich, the executioner, being bitten by the head of a *guillotiné;* of several heads, fallen into the same basket, having bitten each other, &c., were quoted from journal to journal, and struck with horror the good people of Paris.

Some of the medical journals entered a protest against M. Pinel's extraordinary physiological ideas, and the nonsensical stories to which they had given rise. Among others, M. Desprez, surgeon to the Lock Hospital, took the trouble to show the falsity of all this anti-physiological stuff. But MM. Evrard and Beaumetz, both medical men at Beauvais, have done more. They determined to make experiments on the head of a *guillotiné*, and the occasion was afforded them soon after the death of Troppmann, by the execution of a parricide at Beauvais. The results of these experiments were communicated on Friday last to the Medico-legal Society of Paris, and they are really well worth being noticed.

The head of the culprit was delivered to them five minutes after the execution, and was subjected to various processes which are most curious, and imply no small courage on the part of the investigators. First, MM. Evrard and Beaumetz tell us that the head was placed on a table covered with compresses, so as to show the amount of blood which would be obtained. The face was then bloodless, of a pale and uniform hue; the lower jaw had fallen and the mouth was gaping. The features, which were immovable bore an expression of stupor, but not of pain. The eyes were open, fixed, looking straight before them; the pupils were dilated; the cornea had already commenced to lose its lustre and transparency. Some sawdust still stuck here and there to the face, but there was no vestige of any either on the inner surface of the lips or on the tongue. This is an important fact.

The opening of the ear was then carefully cleansed, and the experimenters applying their lips as closely as possible to the orifice called out three times in a loud voice the name of the criminal. Not a feature moved; there was no muscular movement, either of the eyes or on the face. A piece of charpie, saturated with ammonia, was next placed under the nostrils; there was no contraction of the alæ nor of the face. The conjunctiva of each eye was deeply and several times successively cauterized with nitrate of silver; the light of a candle was brought within two centimètres distance of the cornea, and yet no contraction was observed either in the eyelids, eyeball, or the pupils.

Electricity was then resorted to as a more powerful means of excitement of the nervous system. One of Legendre's electric piles, with a current of moderate intensity, determined

vivid contractions in such of the muscles of the face as were directly subjected to its influence. But was this evidence, say the investigators, of a feeling of pain expressed by the physiognomy? Certainly not; and this for two reasons: first, because, whilst the experiment affected the left side of the face, the muscles of the right side retained their expression of stupor, even when the opposite side was the most convulsed; next, because the electrized parts themselves resumed their cadaveric impassibility as soon as the electric current ceased to animate them.

The integuments of the cranium were then incised from the nape of the neck to the root of the nose; the bones of the skull were uncovered down to the zygomatic arches. In performing these incisions, say the investigators, many nerves were cut, of which the section would have been most painful; the muscles of the neck and temple were still alive, since they retracted energetically under the knife; notwithstanding, no contraction of the face, no reflex action was observed. At that time three-quarters of an hour had not yet elapsed since the execution. The skull was then sawn through, and the brain removed; the muscles of the face and those of the jaws continued to obey the electric current, as when the brain was unimpaired. The integuments had then begun to get cold, and yet, with an intense electric current, the same muscular contractions were obtained *half an hour after the extraction of the brain*. Nobody will say that the brain still continued to act and think, though the muscles still responded to electric excitation. Beyond doubt the brain was as lifeless during the first part of the experiment as during the second. Indeed, at the very moment of the execution, through the sudden interruption of circulation, and consequent syncope, the brain was quite as unable to feel as to express its sensations.

This view MM. Evrard and Beaumetz base on the condition of the brain and its envelopes when examined. There was no fluid in the large arachnoid cavity; the vessels of the pia mater were almost bloodless, and filled with aëriform fluid; the lateral cavernous sinuses were absolutely bloodless. The ventricles contained scarcely a teaspoonful of fluid, and in no situation was the brain injected. These facts entirely overthrow what has been advocated by some with regard to the persistence of the cephalo-spinal liquid, and of cerebral nutrition.

The thoracic viscera were also examined. The heart was found to be enormous, and was seen to beat under the pericardium; the lungs shrunken, and of a blackish hue. There was an enormous dilatation of the right auricle, and the ventricle of the same side was also dilated and tense. The left auricle was remarkably small, hard, and retracted. The right auricle and ventricle were filled, not with blood, but with an airy fluid. Pressure reduced their volume to three-fourths of their apparent size. Whilst the contractions of the auricles persisted, those of the ventricles became less frequent. A quarter of an hour after, the auricle and ventricle were once more swollen and distended, and it seemed that air, solicited by the contraction of the auricle, came from the vena cava (which was bloodless and dilated), as well as from the brachio-cephalic venous trunks. An hour and a half after the execution, the contractions of the right auricle were still perceptible, though rare and weak; the right ventricle was then wrinkled, shrunken, and could not contract in the least.

The results of these experiments are in entire accordance with those which had already been obtained in 1803 by the Medical Association of Mayence, which had been led to investigate the subject by the same motives as had actuated MM. Evrard and Beaumetz. The experiments then made, such as calling out the names of the criminals in the respective heads, were much the same as those which I have just related.

The falling of the lower jaw, which takes place instantaneously, serves to explain (to a certain extent), according to MM. Evrard and Beaumetz, all the extraordinary stories of the heads biting each other which have recently been propagated as coming from Sanson and other executioners. The fact would be a mere coincidence, due to the position of the various heads in the basket. Besides, the experimenters assert that Heindrich, the present executioner, has positively assured them that he has never noticed this fact, nor, indeed, any sign whatever of persistent life in the heads of *guillotinés*.—*Lancet*.

HOW TO DETECT ANEURISM.

BY JAMES PAGET, F.R.S.

ALTHOUGH practical medical matters are rather beyond our *métier*, yet the following lecture by Mr. Paget is so able an account of a difficult matter that we cannot resist reproducing it.

On Wednesday week Mr. Paget lectured on a case, under his care, of Aneurism of the Left Common Iliac Artery. The patient is a man aged twenty-nine, who stated that about eighteen months before admission he first began to suffer from pain in the back and lumbar region after bathing in the sea. The pain, which was of no great intensity, persisted, and was believed to depend upon lumbago. Towards the end of 1869, he first noticed a tumour, and, in addition, some numbness in the feet after exertion; about this time Dr. Gull saw him, and, after a physical examination, at once diagnosed the nature of the disease, and sent the man to Mr. Paget, by whom he was afterwards admitted. Mr. Paget remarked on the negative character of this man's symptoms, and on the readiness with which, in the absence of a manual examination, the case might have been mistaken for lumbago, commencing paraplegia, or even hypochondriasis. On admission, he was pale but fairly nourished, and complained of pain in his back and loins and of numbness in the lower extremities after exertion. The heart-sounds were normal, but the circulation generally was somewhat excited. He did not complain of pain down the thighs or in the legs, nor was there any œdema or enlargement of the veins of the lower extremities. On examination, a pulsating tumour was found in the abdomen, situated below and rather to the left of the umbilicus; the pulsation ceased when the abdominal aorta was compressed. Slight pulsation could be felt in the left common femoral artery, but the pulse could not be detected over the posterior tibial of the same side; on the right side the pulse was detected with ease in both these vessels. A slight soft *bruit* was heard on auscultation over the tumour. Mr. Paget considered that the aneurism probably occupied the extremity of the abdominal aorta, and the whole of the left common iliac, and that four vessels communicated with it, viz., the aorta, right common iliac, and left external and internal iliac arteries.

In speaking of the diagnosis of abdominal aneurisms, Mr. Paget said that the difficulty in these cases was twofold; for, first, there were many pulsating tumours not aneurisms; and, secondly, aneurisms were occasionally met with which, at the time of examination, did not pulsate. In the case under consideration the second source of error did not interfere, for the tumour pulsated strongly. The pulsating tumours from which aneurism was to be distinguished were arranged under the heads of *medullary cancer, arterial vascular tumours, tumours growing from bone*, and *enlarged lymphatic glands*, or any other tumour seated upon or around a large artery; and the following points were insisted upon as furnishing, collectively or singly, the means for arriving at a correct conclusion. The *character* of the pulsation: the pulsation of an aneurism was described as "firm, full, and strong," while that produced by any of the other pulsating tumours was said to be weak and soft. Mr. Paget laid great stress on this difference, and considered it a most important aid to diagnosis. The *direction* of the pulsation: the "expanding pulsation" of an aneurism was to be carefully distinguished from the merely "forward push or throb" communicated to the fingers by a tumour seated on

an artery; if a tumour, such as a mass of enlarged glands, however, *surrounded* an arterial trunk, Mr. Paget considered that it might be quite impossible to determine whether an aneurism existed or not, for the pulsation in such a case would be truly expanding in all directions. *Pain* of a "rending" character, and coming on in paroxysms, was mentioned as a valuable sign of aneurism, and probably denoted the occurrence of rapid increase in size. The existence of a *loud rasping bruit* over the tumour and along the artery above and below was said to be a symptom of some value when present, although its absence, as in the patient under consideration, by no means negatived the existence of aneurism, for a soft *bruit* was heard in many cases of vascular tumour.

Mr. Paget alluded to another class of cases in which the diagnosis of abdominal aneurism was sometimes made, and in which there was not only no aneurism, but no tumour of any kind. In some persons, a large artery, generally the abdominal aorta, pulsated very strongly; and it was this strong pulsation of a healthy vessel that was mistaken for aneurism. It occurred, Mr. Paget observed, chiefly in hysterical women or nervous men; sometimes in association with pains in the back, which rendered the resemblance to aneurism still closer; or in persons in whom the bodies of the lumbar vertebræ were unusually prominent, the head of the pancreas enlarged, or the colon distended; and, lastly, a certain number of cases were found to be connected with incessant nausea and vomiting in nervous people—a case being mentioned of a woman who was supposed by several observers to be the subject of abdominal aneurism. She was suffering from excessive and continued seasickness, and, in fact, died of exhaustion from this cause; and Mr. Paget had an opportunity of confirming his previous opinion that no aneurism existed. The absence of the lateral or expanding pulsation in these cases of excessive arterial pulsation was mentioned and insisted on. The lecturer alluded to one case in which a phantom tumour of the rectus abdominis muscle was superadded to a pulsating aorta. In this instance, the diagnosis was at length made by placing the patient under chloroform, when the tumour disappeared completely.

Mr. Paget added that the same state of excessive pulsation was sometimes noticed in other arteries, especially the subclavian and the carotid. If the patient happened to possess a cervical rib over which the pulsating subclavian passed, as in a case lately under Mr. Paget's care, the resemblance to aneurism might be very close. The simulation of carotid aneurism was said to be most deceptive when the internal carotid was elongated and tortuous in old persons, and when the naturally somewhat bulbous condition of the lower part of this vessel was more than usually marked.

THE NEW EXPLOSIVE COMPOUND—DUALIN.

If the accounts that reach us are to be relied upon, this compound bids fair to prove of some value. It is claimed for it that it possesses the slow combustibility of gunpowder with the intense rupturing force of nitro-glycerine, that it may be handled with safety, and that it is not liable to spontaneous combustion.

This explosive is the invention of Carl Dittmar, of Charlottenberg, Prussia, who thus describes it.

"Dualin is a yellowish-brown powder, resembling, in appearance, Virginia smoking tobacco. It will, if lighted in the open air, burn without exploding; but, if confined, it may be made to explode in the same manner as common powder. It is not sensitive to concussion; will not decompose by itself, nor cake or pack together; may be readily filled into cartridges; and it matters not whether the place where it is stored be warm or cold, dry or damp. It has from four to ten times the strength of common powder, and is stronger than dynamite. . . . .

"Dualin consists of cellulose, nitro-cellulose, nitro-starch, nitro-mannite, and nitro-glycerine, mixed in different combinations, depending on the degree of strength which it is desired the powder should possess in adapting its use to various purposes."

The preparation of cellulose, nitro-starch, nitro-mannite, and nitro-cellulose, involves several distinct processes.

How future trials may affect the popularity of dualin, if it can at present be said to have acquired popularity, we cannot undertake to say. It is only fair to say that in the opinion of some good judges, it is decidedly inferior in power to dynamite, though it is said to be cheaper. It will explode in contact with flame which does not ignite dynamite. On the contrary, it may be used in temperatures which freeze dynamite and render the latter incapable of being directly exploded. But dynamite may be used when wet, and may even be exploded under water in drill-holes; while dualin, like gunpowder, is, we are informed, useless when wet. This fact gives dynamite an immense advantage over dualin for mining and engineering purposes.

The claims of dualin to take front rank as an explosive cannot yet be conceded, but there is little doubt that it is far better than many other compounds which the last few years have brought forth. Before it can gain the full confidence of miners and engineers, it must undergo many more trials than have yet been made. It is, however, only just to say that reports from the Hoosac tunnel, where it has been successfully tried, are highly favourably.

We learn that experiments were made in the United States, January 5th, 1870, in a quarry near Washington City, belonging to the Messrs. Lewis & Hall; January 18th and 19th, at Hoosac Tunnel; and January 22nd, at Roxbury, near Boston, Massachusetts.

The attested results of these trials leave no doubt in our minds that dualin is much superior to nitro-glycerine.—*Scientific American*, March 5.

ON COMETS AND METEORS.

BY DANIEL KIRKWOOD, LL.D.,
Professor in Indiana University.

IN TWO PARTS.—PART I.

The comets which passed their perihelia in August, 1862, and January, 1866, will ever be memorable in the annals of science, as having led to the discovery of the intimate relationship between comets and meteors. These various bodies found revolving about the sun in very eccentric orbits may all be regarded as similar in their nature and origin, differing mainly in the accidents of magnitude and density. The recent researches, moreover, of Hoek, Leverrier, and Schiaparelli, have led to the conclusion that such objects exist in great numbers in the interstellar spaces; that in consequence of the sun's progressive motion they are sometimes drawn towards the centre of our system; and that if undisturbed by any of the large planets they again pass off in parabolas or hyperbolas. When, however, as must sometimes be the case, they approach near Jupiter, Saturn, Uranus, or Neptune, their orbits may be transformed into ellipses. Such, doubtless, has been the origin of the periodicity of the August and November meteors, as well as of numerous comets.

In the present paper it is proposed to consider the probable consequences of the sun's motion through regions of space in which cosmical matter is widely diffused; to compare these theoretical deductions with the observed phenomena of comets, aërolites, and falling stars; and thus, if possible, explain a variety of facts in regard to those bodies, which have hitherto received no satisfactory explanation.

1. As comets now moving in elliptic orbits owe their periodicity to the disturbing action of the major planets, and as this planetary influence is sometimes sufficient, especially in the

case of Jupiter and Saturn, to change the *direction* of cometary motion, the great majority of periodic comets should move in the same direction with the planets. Now, of the comets known to be elliptical, 70 per cent. *have direct motion*. In this respect, therefore, theory and observation are in striking harmony.

2. When the relative positions of a comet and the disturbing planet are such as to give the transformed orbit of the former a small perihelion distance, the comet must return to the point at which it received its greatest perturbation; in other words, to the orbit of the planet. The aphelia of the comets of short period ought therefore to be found, for the most part, *in the vicinity of the orbits of the major planets*. The actual distances of these aphelia are as follows:—

I. *Comets whose Aphelion Distances are nearly equal to* 5·20, *the Radius of Jupiter's Orbit.*

Comets.	Aph. Dist.	Comets.	Aph. Dist.
1. Encke's	4·09	7. 1766 II.	5·47
2. 1819 IV.	4·81	8. 1819 III.	5·55
3. De Vico's	5·02	9. Brorsen's	5·64
4. Pigott's (1783)	5·28	10. D'Arrest's	5·75
5. 1867 II.	5·29	11. Faye's	5·93
6. 1743 I.	5·32	12. Biela's	6·19

II. *Comets whose Aphelion Distances are nearly equal to* 9·54, *the Radius of Saturn's Orbit.*

Comets.	Aph. Dist.
1. Peters' (1846 VI.)	9·45
2. Tuttle's (1858 I.)	10·42

III. *Comets whose Aphelion Distances are nearly equal to* 19·18, *the Radius of Uranus's Orbit.*

Comets.	Aph. Dist.
1. 1867 I.	19·28
2. Nov. Meteors	19·65
3. 1866 I.	19·92

IV. *Comets whose Aphelion Distances are nearly equal to* 30·04, *the Radius of Neptune's Orbit.*

Comets.	Aph. Dist.
1. Westphal's (1852 IV.)	31·97
2. Pons's (1812)	33·41
3. Olbers's (1815)	34·05
4. De Vico's (1846 IV.)	34·35
5. Brorsen's (1847 V.)	35·07
6. Halley's	35·37

The coincidences here pointed out (some of which have been noticed by others) appear, then, to be necessary consequences of the motion of the solar system through spaces occupied by meteoric nebulæ. Hence the observed facts receive an obvious explanation.

In regard to comets of long period we have only to remark that, for anything we know to the contrary, there may be causes of perturbation far exterior to the orbit of Neptune.

3. From what we observe in regard to the *larger* bodies of the universe—a clustering tendency being everywhere apparent—it seems highly improbable that *cometic and meteoric* matter should be uniformly diffused throughout space. We would expect, on the contrary, to find it collected in cosmical clouds, similar to the visible nebulæ. Now, this, in fact, is precisely what has been observed in regard both to comets and meteors. In 150 years, from 1600 to 1750, 16 comets were visible to the naked eye;[1] of which 8 appeared in the 25 years from 1664 to 1689. Again, during 60 years, from 1750 to 1810, only 5 comets were visible to the naked eye, while in the next 50 years there were double that number. The probable cause of such variations is sufficiently obvious. As the sun in his progressive motion approaches a cometary group, the latter must, by reason of his attraction, move toward the centre of our system, the nearer members with greater velocity than the more remote. Those of the same cluster would enter the solar domain at periods not very distant from each other; the forms of their orbits depending upon their original relative positions with reference to the sun's course, and also on planetary perturbation. It is evident also that the passage of the solar system through a region of space comparatively destitute of cometic clusters would be indicated by a corresponding paucity of comets. By the examination, moreover, of any complete table of falling stars we shall find a still more marked variation in the frequency of meteoric showers.

Previous to 1833, the periodicity of shooting stars had not been suspected. Hence the showers seen up to that date were observed *accidentally*. Since the great display of that year, however, they have been regularly *looked for*, especially at the November and August epochs. Consequently the numbers recently observed cannot properly be compared with those of former periods. Now, according to the Catalogue of Quetelet, 244 meteoric showers were observed from the Christian era to 1833. These were distributed as follows:—

Centuries.	No. of Showers.	Centuries.	No. of Showers.
0 to 100	5	1000 to 1100	22
100 to 200	0	1100 to 1200	12
200 to 300	3	1200 to 1300	3
300 to 400	1	1300 to 1400	4
400 to 500	1	1400 to 1500	4
500 to 600	20	1500 to 1600	7
600 to 700	1	1600 to 1700	7
700 to 800	14	1700 to 1800	24
800 to 900	37	1800 to 1833	48
900 to 1000	31		

A remarkable secular variation in the number of showers is obvious from the foregoing table. During the five centuries from 700 to 1200, 116 displays are recorded; while in the five succeeding, from 1200 to 1700, the number is only 25. It will also be observed that another period of abundance commenced with the eighteenth century. A catalogue of meteoric stone-falls indicates also a corresponding increase in the number of aërolites, which cannot be wholly accounted for by the increased number of observers. Now, there are two obvious methods by which these variations may be explained. Either (1) the orbits of the meteoric rings which intersect the earth's path were so changed by perturbation towards the close of the twelfth century as to prevent the appulse of the meteoric groups with the earth's atmosphere; or (2), the nebulous matter is very unequally diffused through the sidereal spaces. That the former has not been the principal cause is rendered extremely probable by the fact that the number of epochs of periodical showers was no greater during the cycle of abundance than in that of paucity. We conclude, therefore, that during the interval from 700 to 1200 the solar system was passing through, or near, a meteoric cloud of very great extent; that from 1200 to 1700 it was traversing a region comparatively destitute of such matter; and that about the commencement of the eighteenth century it again entered a similar nebula of unknown extent.—*Paper read before the American Philosophical Society*, Nov. 19, 1869.

ON THE TEMPERATURE AND ANIMAL LIFE OF THE DEEP SEA.

BY WILLIAM B. CARPENTER, M.D., F.R.S.

IN FOUR PARTS.—PART I.

THE present discourse embodies the most important general results obtained by the exploration of the deep sea in the neighbourhood of the British Isles, carried on during the summer of 1869 in H.M. surveying-vessel *Porcupine*, with the view of completing and extending the inquiries commenced in the *Lightning* expedition of 1868, of which an account was given by the speaker at the Friday evening meeting of the Royal Institution of April 9, 1869.[1]

The expedition of the *Porcupine* was divided into three cruises. The first of these, which was placed under the scientific charge of Mr. J. Gwyn Jeffreys, F.R.S., accompanied by Mr. William L. Carpenter as chemical assistant, commenced from

[1] See Humboldt's *Cosmos*, vol. iv. p. 538. The writer called attention to this variation as long since as 1861.

[1] *Proceedings of the Royal Institution*, vol. v. p. 503, and SCIENTIFIC OPINION, vol. i. p. 180.

Galway near the end of May, and concluded at Belfast at the beginning of July. It was directed in the first instance to the south-west, then to the west, and finally to the north-west as far as the Rockall Bank. The greatest depth at which temperature-sounding and dredging were carried on in this cruise was 1,476 fathoms; and these operations, through the excellent equipment of the *Porcupine* and the skill of her commander, Captain Calver, were so successfully performed that it was confidently anticipated that still greater depths might be reached with an equally satisfactory result.

The second cruise, which was under the scientific charge of Professor Wyville Thomson, F.R.S., with Mr. Hunter as chemical assistant, was consequently directed to the nearest point at which a depth of 2,500 fathoms was known to exist, viz., the northern extremity of the Bay of Biscay, about 250 miles to the west of Ushant. In this cruise temperature-sounding and dredging were carried down to the extraordinary depth of 2,345 fathoms, *or nearly three miles*—a depth nearly equal to the height of Mont Blanc, and exceeding by more than 500 fathoms that from which the Atlantic cable was recovered. This sea-bed, on which the pressure of the superincumbent water is nearly *three tons for every square inch*, was found to support an abundance of animal life, about 1½ cwt. of "Atlantic mud," chiefly consisting of Globigerinæ, having been brought up in the dredge, together with various types of higher animals, Echinoderms, Annelids, Crustaceans, and Mollusks; among them a new Crinoid—referrible, like the Rhizocrinus, whose discovery by M. Sars, jun., had been the starting-point of the present inquiry—to the Apiocrinite type which flourished during the Oolitic period.

The third cruise was under the scientific charge of the speaker, with Mr. P. H. Carpenter as chemical assistant; but he had the great advantage of being accompanied by his colleague Professor Wyville Thomson, who, as in the *Lightning* expedition, took the entire superintendence of the dredging operations. The object of this cruise, which commenced in the middle of August and terminated in the middle of September, was a more thorough exploration of the area between the North of Scotland and the Faroe Islands, which had been found in the *Lightning* expedition to afford results of peculiar interest in regard alike to the inequality of temperature and to the distribution of animal life on the sea-bed, which here ranges between the comparatively shallow depths of from 350 to 650 fathoms—the last-named being the greatest depth to which dredging had been carried in 1868.

The weather during nearly the whole of the *Porcupine* expedition was as favourable to its work as during the greater part of the *Lightning* expedition it had been unfavourable, and the results obtained not only far exceeded the most sanguine expectations of those who promoted it, but may be said without exaggeration to be such as no previous scientific exploration of so limited an extent and duration is known to have yielded.

The results of the *temperature-soundings* will be first stated, with their bearing on the doctrines advanced in the former discourse as probable inferences from the observations made during the *Lightning* expedition. These observations indicated that two very different sub-marine climates exist in the deep channel which lies E.N.E. and W.S.W. between the north of Scotland and the Faroe banks, a *minimum* temperature of 32° having been registered in some parts of this channel, whilst in other parts of it, at *the like depths* and with *the same surface temperature* (never varying much from 52°), the *minimum* temperature registered was never lower than 46°, thus showing a difference of 14°. It could not be positively asserted that these *minima* are the *bottom*-temperatures of the areas in which they respectively occur; but it was argued that they must almost necessarily be so—first, because it is highly improbable that sea-water at 32° should overlie water at any higher temperature which is specifically lighter than itself, unless the two strata have a motion in opposite directions sufficiently rapid to be recognizable; and second, because the nature of the animal life found on the bottom of the cold area, which consists of quartzose sand, including volcanic particles, exhibited a marked correspondence with its presumed reduction of temperature, whilst the sea-bed of the warm area is essentially composed of Globigerina mud, and the animal life which it supports is characteristic of the warmer temperate seas.

This conclusion, it is obvious, would not be invalidated by any error arising from the effect of pressure on the bulbs of the thermometers; since, although the *actual minima* might be, as was then surmised, from 2° to 4° below the *recorded minima*, the *difference* between temperatures taken at the same, or nearly the same depths, would remain unaffected.

The existence in the cold area of a *minimum* temperature of 32°, with a fauna essentially boreal, could not, it was argued, be accounted for in any other way than by the supposition of an under-current of polar water coming down from the north or north-east; whilst, conversely, the existence in the warm area of a *minimum* temperature of 46°, extending to 500 or 600 fathoms' depth, in the latitude of 60° (being at least 8° above its isotherm), together with the warmer-temperate character of its fauna, seemed equally indicative of a flow of equatorial waters from the south or south-west.

It was further urged that if the existence of two such different submarine climates in close proximity can only be accounted for on the hypothesis of an Arctic stream and an equatorial stream running side by side (the latter also spreading over the former in consequence of its lower specific gravity), these streams are to be regarded (like the Gulf Stream) as particular cases of a *great general oceanic circulation*, which is continually bringing the water cooled down in the polar regions into the deepest parts of the equatorial ocean-basins, whilst the water heated in the equatorial regions moves towards the poles on or near the surface. Such a circulation was long since pointed out to be as much a physical necessity as that interchange of *air* between the equatorial and polar regions, which has so large a share in the production of winds; but whilst physical geographers remained under the dominant idea that the temperature of the Deep Sea is everywhere 39°, they could not fully recognize its importance.

These doctrines have been fully tested by the very numerous and careful temperature-soundings taken in the *Porcupine* expedition; and the result has been not merely to confirm them in every particular—so that they may now take rank as established facts,—but also to show that a temperature 2½° *below the freezing point of fresh water* may prevail over the sea-bed in a region far removed from the polar, and that even this extreme reduction is by no means antagonistic to the existence of animal life in great variety and abundance.

All the temperature-soundings of the *Porcupine* expedition were taken with thermometers protected from the effects of pressure by the inclosure of the bulb of each instrument in an outer bulb, sealed round the neck of the tube; about three-fourths of the intervening space being filled with spirit, but a small vacuity being left, by which any reduction in the capacity of the outer bulb is prevented from communicating pressure to the inner. This plan of construction, which was suggested by Professor W. A. Miller, has been so successfully carried into practice by Mr. Casella, that thermometers thus protected have been subjected to a pressure of *three tons on the square inch*, in a testing machine devised for the purpose, without undergoing more than a very slight elevation, of which a part, at least, is attributable to the heat given out by the compression of the water in which they were immersed; whilst the very best thermometers of the ordinary construction were affected by the same pressure to the extent of 8° or 10°, the elevation in some instruments reaching as much as 50° or 60°.[2] Two of these protected

[2] See Professor W. A. Miller's "Note upon a Self-Registering Thermometer, adapted to Deep-Sea Soundings," in *Proceedings of the Royal Society*, June 17, 1869, and SCIENTIFIC OPINION, vol. ii. p. 115.—The same principle had been previously applied in thermometers constructed under the direction of Admiral Fitzroy; the space between the two bulbs, however, being occupied with mercury instead of spirit. Owing, however, to some imperfection in their construction, their performance was not satisfactory, and they were found very liable to fracture.

Miller-Casella thermometers were used in each observation; and they always agreed within a fraction of a degree. The same pair was used throughout the expedition; and notwithstanding that they were used for 166 separate observations, in which they travelled up and down nearly 100 miles, they came back in perfectly good order—a result mainly due to the care with which they were handled by Captain Calver. It may be affirmed with great confidence that the temperatures which they indicated were correct within 1° Fahr.; an approximation quite near enough for the scientific requirements of the case.—*Lecture delivered before the Royal Institution.*

PROPAGATING THE LARCH FROM SEED.

BY D. C. SCOFIELD, ELGIN, ILLINOIS, U.S.

TWO prominent difficulties are encountered in this country which, I believe, are unknown in Europe; the hot rays of the sun having the double tendency to scald or heat the soil, so that it causes the plant to die at the collar, or, as the phrase has it, "damp off," as well as to scorch the tender plant as it emerges from the earth. These are overcome first by selecting a light, sandy, dry, though rich soil, for the seed-bed; and, secondly, by a partial shading the first season, which may be best done by nailing strips of lath 1 inch apart, and placing them, 1 foot in height, over the seed-bed, so as to partially obstruct the rays of the sun. Any other material that will render the same amount of shade will answer.

The soil where the seed is to be sown should be as clean from weed-seed as possible. The usual time of sowing onion seed, or from middle of April till 1st of May, is the time to sow larch. It may be sown in drills, 4 or 6 inches apart, or broadcast, and covered just enough to retain moisture until it germinates. It may be sown as onion or other seed, without preparation. Clean culture is indispensable. The shading may be dispensed with after the first season. The seedlings should be transplanted either at one or two years old from the seed-bed. This should be done, as soon as the weather and soil will permit, in the spring, in a similar soil to that in which they were grown, and better at one year old than two. Transplant in beds, in rows 6 inches apart and 4 inches in the row, and shade as directed for the seed-bed. The roots should be kept from the atmosphere as much as possible in transplanting. With good seed a satisfactory success will be realized. This method will apply with equal success in propagating any variety of hardy evergreens.—*The Farmer.*

An Antidote to Chloral.—M. Liebreich, of Berlin, after having studied and made known the physiological properties of hydrate of chloral, has directed his attention to the obtainment of a remedy which may counteract the baneful effects of the substance. This antidote he asserts to be strychnia. The results of M. Liebreich's novel researches were laid before the French Academy of Sciences a few days ago, by Professor Wurtz, of the Paris Faculty. M. Wurtz stated that the attention of the Berlin experimenter had been drawn to strychnia by the observation of a case of trismus, which, after having persisted eight days, was immediately cured on the employment of chloral. This led him to produce, artificially, the phenomena of tetanus in animals by the administration of strychnia, in order to study the effects of chloral on this artificial condition. He then observed that chloral diminished the effects of strychnia, provided it were exhibited very soon after the administration of the alkaloid. Another important result was obtained when M. Liebreich, pursuing his researches, discovered the effect of strychnine on animals poisoned by large doses of chloral. He then made out that strychnia, administered after a too heavy dose of chloral, shortens and destroys the effects of this substance, yet without producing the injurious action which it exhibits in ordinary cases. Therefore, M. Liebreich proposes to employ injections of nitrate of strychnia as an antidote in cases where accidents have occurred through an overdose of chloral or chloroform.—*Lancet.*

REVIEWS OF BOOKS.

Cassell's Book of Birds. Translated and Adapted from the Text of the eminent German Naturalist, Dr. BREHM, by THOMAS RYMER JONES, F.R.S., Professor of Natural History in King's College, London. Parts I., II., and III. London: Cassell. 1870.

MESSRS. CASSELL have from time to time done much good service to the cause of education by the publication of cheap scientific works, which placed all departments of science within reach of even the least wealthy of the artisan classes. Their *Popular Educator* was a work to which we doubt not science is indebted for many an ardent and distinguished student; and, though some of their other publications have not had so high a status as we could have desired, they have nevertheless been useful. In the fine work on birds which they have employed Professor Rymer Jones to "adapt" from the German of Brehm, we find a book so cheap that all may possess it, and yet so excellent a popular treatise that we know of none that can be compared with it. It is of the largest 8vo size, is printed in clear type on excellent paper, and, besides containing a multitude of capital woodcuts and page engravings, each part is furnished with a beautifully-coloured illustration of the type of bird to the description of which the part is devoted. Indeed, it is only fair to say that this single illustration, often involving the use of six or more different colours, is really worth the money paid for the "part."

In speaking critically of the text of the work, it is essential to remember that this book is intended for the people and not for the scientific naturalist; its object is rather to cultivate in the minds of the masses a taste for ornithology and a knowledge of the leading facts in this branch of science, than to convey a philosophic survey of the relations of birds to other vertebrates or to each other. Indeed, were it attempted to give the work any higher character than this, it would have been necessary to have laid out quite a different plan to that pursued by the enterprising publishers, and Professor Jones would have been compelled to restrain that happy mode of popularization of which he is so perfect a master. If we were to take any other view of the matter we should be compelled to relentlessly expunge the whole of the editorial introduction.

Professor Jones, before entering on the description of the feathered tribes, to the study of which Brehm gave up his life, gives an outline of the construction of the body of the bird and of the general physiology of the group. This, so far as it concerns any work done of late years, might have been written a quarter of a century since, and though it is not inaccurate, it is, even for a popular sketch, not quite so full as we could have wished. That it is charmingly written those who know any of Mr. Jones's works will not doubt for a moment; the style is fascinating, and is well calculated to attract readers to the work. But we think that a few of the more important recent generalizations might have been thrown in with advantage, and as the work is yet far from its conclusion, we would propose that the last "part" should include a supplementary chapter, in which the relations of birds to reptiles might be illustrated by the remarkable facts in palæontology which have of late years come to light. A few restorations of *Iguanodon*, *Comsognathus*, and *Archæopteryx*, would greatly enhance the value of this fine work.

We think that Professor Jones greatly over-estimates the importance of hollow bones as one of the conditions of flight in birds, and that in treating of the air-cavities in bone, &c., as of use to the bird in singing prolonged notes, he is speaking rather on *à priori* grounds than from actual experiment. So far as we can see, the air contained in the bones of birds could serve no useful purpose whatever in the ordinary vocal operations, and we should be glad to know on what principle Professor Jones thinks otherwise. In regard to the other parts of the Intro-

THE DESERT TRUMPETER (*BUCANETES GITHOGENEUS*). [See p. 288.

duction we can only say that we think them full of interest, and that the abundant illustrations serve to make the editor's remarks most clear. Not the least useful part is that which relates to the terminology descriptive of the several external parts of the bird. This is accompanied by an excellent wood-cut, in which each part is so distinctly indicated that the young ornithologist cannot fail to make himself easily and speedily familiar with the expressions employed in the scientific description of birds. We shall hope to reproduce both the account and the illustration in an early number.

Of the system of classification pursued in the *Book of Birds* we can say but little, from the circumstance that no scheme is laid down in the Parts which have yet reached us. It would seem, however, that a peculiar and, we should be disposed to think, very empirical method of division is about to be pursued, if we may judge from the opening group. It is proposed to reject the more common plans of arrangement such as are familiar to all who know even elementary zoology, and to follow a special mode of grouping which in the Order treated of first is founded almost solely on the habits of the birds, and hence includes families which were before united under one division. The first order, then, and that to which the Parts before us are confined, is termed ENUCLEATORES, or Crackers, because the birds grouped under it have the power of cracking nuts and other hard seeds by virtue of a peculiar construction of the beak. Examples of the order are afforded by the Parrots, Cockatoos, and all that well-known family, and in addition, the Crossbills and Bullfinches. We cannot approve of what

we regard as a very heterogeneous mode of grouping birds, and unless in the future Parts of this work a scheme more in accordance with existing views is adopted, we shall have reason to be disappointed with this otherwise fine treatise.

The account of the several species of parrots, &c., which is given in the three Parts under notice is excellent, and is most agreeable reading, and of the woodcuts scattered through the text it would be impossible to speak too highly. They are wonderful specimens of both artist's and engraver's skill. We shall, probably, in a future number, reproduce others of them, but for the present we are content to direct our readers' attention to the handsome figure of the Desert Trumpeter (see p. 257), the engraving of which has been courteously lent by the publishers.

It will be seen that, taking them all in all, we have a very high opinion of the three first Parts of Messrs. Cassell's handsome treatise; but it yet remains to be seen whether the future issues will tend to confirm this favourable impression.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

The Annual Average of Earthquakes.

Sir,—Will either you, or any of your readers who may have access to the memoirs read before the Royal Academy of Belgium, be so good as to inform me whether there was any *notable* difference between the number of earthquakes of 1868, and that of the average from 1843 to 1867, as recorded by M. Perrey?

If this information, which is of great interest to me, cannot be supplied, can you kindly inform me whether a copy of M. Perrey's memoir can be purchased in London? Yours respectfully,

P. H. G.

[We regret that the information required by our correspondent is not yet to be had. The memoir of M. Perrey is not yet printed. At the meeting on the 3rd ult., it was referred to a commission consisting of MM. Ad. Quetelet and Duprez. It will appear in the next *Bulletin*, and we shall then be happy to answer "P. H. G.'s" query.—Ed. *S.O.*]

Sir William Thomson *versus* Mr. Menteath.

Sir,—I must still persist in maintaining that it is somewhat unjust of Mr. Menteath to continue his heading "Sir William Thomson *versus* Geology," for Sir William Thomson's words are—"Avowedly and explicitly I attacked *Uniformitarianism*, *but I did not attack geological speculation in general*" (the italics are mine); yet, although it is here clearly stated that only certain theories are assailed, the continued heading of Mr. Menteath's letter implies that *all* geology is opposed to his opponent. Mr. Menteath says that Sir W. Thomson "attacks the whole value and method of geological reasoning," but he must show definitely *what the true geological reasoning really is* before he can make this assertion, and he must *prove* his theories to be right—as to assume this is to assume the whole question in dispute. I asked Mr. Menteath to *prove* his statement that the geological record "may represent but a trifling fragment of the history of the earth." He has not done so; and all he has said is that he *believes* it to be *possible*, and he knows of nothing against it. This is his *opinion*, but, unless it can be supported by argument, opinion is of little weight, and such a statement cannot possibly satisfy any one: it is easy to make assertions, but not so easy to prove them. If the record be but a *small fragment* of the earth's history, then why is it so perfect? We can mark a time when (according to the greatest authorities) life was limited to but a few forms, and trace the rise of different classes and orders, while each life-period has its peculiar forms, and it will never do to try to invalidate the testimony of the *known* by vague *assumptions* of the *unknown*.

Mr. Menteath objects to any limit to geological time because he "holds that not the slightest reliable proof of any limit has been found." But this again is nothing but a mere statement of his *opinion*. I have shown that Professor Phillips has fixed such a limit; he is not alone in this, and the Duke of Argyll, speaking of geological time, observes, "Its periods are indeed very long, but the beginning of them can be seen. It is not a boundless ocean, it is only a very broad sea. On the other side of it there rise the mountains of a lifeless land. Successive creations mark the distance between us and them, and, although we cannot say what that distance is, we can say that it is a finite distance."—*Primeval Man*, pp. 125, 126.

As to the form of the earth, I could name most eminent geologists, who have said that it took this form owing to igneous fluidity. Mr. Menteath can name others who do not hold to this; but the great fact is to be considered by all, and when I am told that "to the Uniformitarian, no explanation of the earth's form is required," I reply that it is falsely put, and that if the Uniformitarian *will* shut his eyes

to the evidence of a beginning, and refuse to admit data from other sciences his theory must be a very weak one. What can be meant by the Uniformitarians knowing "no reason for supposing that the shape of the earth was primævally bungled" I do not know, unless it be imagined that it would be bungled unless shaped after Mr. Menteath's peculiar ideas.

All through his notice of my remarks, Mr. Menteath *has not attempted to prove one single statement* of his, and he can never expect any one to rely on his simple assertions in questions on which his compeers are still divided in their opinions; and I must hold that he has been equally superficial in his remarks on the excellent letter of your correspondent "R. A." True it is, Mr. Menteath promises that he is going to prove the truth of Uniformitarianism, and it is high time that he should give us something in the way of *argument*, for up to this time we have, I fear, had nothing but mere evasions of difficulties without solutions, and dogmatic statements of opinion instead of definite proofs. But Mr. Menteath is, I am afraid, a little too harsh to Sir William Thomson in the manner in which he speaks of him; thus, he speaks of Sir William Thomson's "meaningless pedantry" (!!) and of his "presumptuous ignorance" (!); but surely a controversialist should be more temperate than this; and Mr. Menteath will do his cause no good by speaking thus. Again, we are told that "Uniformitarianism is a necessary principle of common sense," I deny it, and I shall be most happy to see how Mr. Menteath will prove this assertion, and he surely cannot mean that the great leaders of the Catastrophists, who are among the very first of geologists, are wanting in common sense! Thus it is that, all through his letters, Mr. Menteath has spoken as if Uniformitarianism were really a *settled fact* and not the point in dispute, and perhaps after all it will be found that the opinions of Sir W. Thomson are not so vague as has been supposed, for the geologist has to do with any objections, from whatever science they may be gathered, and to give them an earnest and thoughtful consideration, especially when they come from the highest of scientific authorities.

A Young Beginner.

The Supposed Planet Vulcan:—*From* William F. Denning.

Sir,—It may interest your astronomical readers to know that another systematic search for the suspected new planet Vulcan is about to be commenced by members of the Observing Astronomical Society. There will be about twenty-five gentlemen engaged in the affair, many of whom are in the possession of very powerful telescopes. It is intended to keep the sun continually under observation when visible during the period from March 20 to April 10, and there is no doubt that the search will be carried on satisfactorily, if not successfully. The list of those who intend taking part in the observations includes the names of Messrs. W. R. Birt, F.R.A.S., J. Birmingham, J. G. E. Elger, Jno. Watson, F.R.A.S., T. P. Barkas, F.G.S., Geo. J. Walker, J. W. Backhouse, A. P. Holden, H. W. Hollis, F.R.A.S., Rev. James Parkes, F.R.A.S., W. J. H. Beechey, F.R.A.S., Henry Pratt, James Cook, and others. I will duly let you know the result.

I am, dear Sir, truly yours,

William F. Denning, Hon. Sec. Observing Astronomical Society.

Ashley-road, Bristol, March 19.

Some Remarkable Curative Effects of Electricity.

Sir,—I believe it has long been an established fact that cases of obstinate neuralgia, which have defied all other remedies, will frequently yield to the application of electricity; but I am not aware that its extreme usefulness in cases of sudden accidents, and in those of temporary local inflammation, is so well known. I have no theories on the subject; mine is merely the experience of practice, and I leave it to wiser heads to explain the matter scientifically. The following are the most striking cases that have come under my notice while using Davis & Kidder's Magneto-electric Machine:—

A man's thumb was crushed edgeways in a door, causing intense pain and destroying the power of bending the joint; a gentle current was immediately passed through it, and in a few seconds pain ceased, and the patient could bend his thumb as usual; nor did the pain return, though the thumb remained black for three months, and the nail came off.

A groom was kicked on the shin by a horse, just as he had been ordered to carry his master's bag a mile, and found it impossible to walk, so great was the pain running down into the foot. The negative pole was placed above the wound, the positive underneath the foot, and in less than five minutes the pain was confined to the sore spot on the shin. The man walked off and complained no more.

A lady, thrown out of a carriage, broke her collar-bone, and after it was set severe pain came on, which was daily relieved by the application of electricity.

A woman of fifty, suffering from a whitlow of the worst kind, took morphia in order to procure a night's rest; but the sickness induced prevented her repeating the dose the following evening, and the machine was brought into use. One pole was applied to the middle joint below the whitlow, the other near the wrist, when, after a few minutes, pain ceased, and a good night's sleep was the result. It had, however, to be eventually opened by a surgeon, who, at the patient's request, administered chloroform, leaving her in a half-fainting state, no brandy or other such stimulant being allowed in order to bring her round. When able to speak she complained that all her left side was still tingling with the chloroform. She was then made to hold the negative pole in the left hand while the positive was placed under her left foot, when two minutes sufficed to rouse her completely, and she got up and walked out of the room.

A stout man of forty suffered every winter from a quinsy, and had all the premonitory symptoms of swelling, choking, &c., when he was induced to try electricity. His feet were placed in a basin of hot water, into which the positive pole or right handle had been dropped, the left being freely applied to the throat in every direction, so that the current might pass through the inflamed part. This was done three evenings running for about five minutes, and the man was cured, the quinsy never coming to a head, although it had never been stopped before.

In an inflammatory cold and cough, with difficulty of breathing, I have myself used it when mustard plasters proved useless. The positive pole was placed between the shoulder-blades, the negative moved about below the collar-bone till the tender spot was found, when a gentle current kept up for five minutes produced ease of breathing, resulting in a quiet night.

But perhaps the cure which surprised me most was when I was sickening for an almost universal influenza. For three days and nights I had been unable to eat or sleep—headache, shivering, pains in the throat and right side, and that feeling best described as being "ill all over" told what was coming. I determined to arrest it if possible. Sitting in a warm hipbath I placed the right pole in the water, holding the other in both hands, and applying it to throat and side for ten minutes, when a genial glow warmed the hitherto cold extremities, and deep sleep followed, from which I awoke perfectly well.

A. B.

The Cause of the Periodicity of Solar-spots Examined.—*From* Andrew Elvins.

Sir,—So Mr. Proctor will not withdraw his protest. Permit me, then, to withdraw the objectionable term "discovered," and in future let the sentence read as above.

I am glad Mr. Proctor has stated one objection in plain terms; and as he promises others if this is met, it is with pleasure that I attempt to answer what we may call objection No. 1.

Mr. Proctor asks "*why* the November meteors should drop into the sun," and he asserts that the earth is more likely to do so than the meteors.

To the question I reply: The meteors could not fall into the sun if they did not come into contact with other bodies; or be thrown from the old into new orbits by the attraction of larger bodies, such as planets. I need not say to Mr. Proctor, that when a small body passes near a larger body it will be deflected from the course it would have followed but for their mutual attraction. The November meteors must sometimes pass near the outer planets Saturn, Jupiter, and Mars; more frequently near the Earth. Many fall on the planets in all probability, and certainly we get many of them as our visitors; the largest of those meteors are very small when compared with the planets, and must be so powerfully acted on by those mighty bodies that we need not wonder *why* they leave their orbits; *we might be amazed if they did not.*

The fact is, the orbits of meteors must be frequently changed; and as some pass very near the planets, some further from them, some will be more deflected than others will. *No single orbit can possibly represent the path of the entire group*, and, out of the millions which are thus forced into new orbits, we risk nothing in saying that some may, *nay, must*, fall into the sun.

In this manner Lexels' comet was really acted on by Jupiter, and sent whirling into space, no one knows where; and should the earth pass near a body as much larger than itself, as the earth is larger than the largest meteorite, it would be sent more rapidly than we could wish, to a region whose temperature might be higher than would be for Mr. Proctor's comfort or mine.

As we pass near no such body, we need not be alarmed; but the meteors are not so safe. If I understand Mr. Proctor, I have fairly answered his *objection*: will he kindly give us No. 2?

I am, Sir, truly yours,

Feb. 28. Andrew Elvins.

P.S.—I will defer my third paper on the subject, until the objections of Mr. P. and others may be included and examined. A. E.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, MARCH 17TH.—The papers read were upon "The Law which regulates the Magnitude of the Areas of the Four Orifices of the Heart," by Dr. Herbert Davies; and "On the Estimation of Ammonia in Atmospheric Air," by Mr. Horace T. Brown. The former was a paper of very considerable length, and as the report of it only reached us late last evening, we are obliged to defer its publication till our next issue.

GEOLOGICAL SOCIETY.

MARCH 9TH.—Warington W. Smyth, Esq., F.R.S., vice-president, in the chair. John Alleyne Bosworth, Esq., of Humberston, Leicestershire; Robert Erskine Brown, Esq., of Wass, Oswaldkirk, Yorkshire; Major E. H. Sladen, Madras Staff Corps, Church-road, Upper Norwood; and Henry King Spark, Esq., Greenbank, Darlington, were elected fellows of the society.

The following communications were read:—"On the Structure of a Fern-stem from the Lower Eocene of Herne Bay, and on its allies, recent and fossil," by W. Carruthers, Esq., F.L.S., F.G.S.—The author described the characters of the fossil-stem of a fern obtained by George Dowker, Esq., F.G.S., from the beach at Herne Bay, and stated that in its structure it agreed most closely with the living *Osmunda regalis*, and certainly belonged to the Osmundaceæ. The broken petioles show a single crescentic vascular bundle. The section of the true stem shows a white parenchymatous medulla, a narrow vascular cylinder interrupted by long slender meshes from which the vascular bundles of the petioles spring, and a parenchymatous cortical layer. The author described the arrangement of these parts in detail, and indicated their agreement with the same parts in *Osmunda regalis*. He did not venture to refer the fern, to which this stem had belonged, positively to the genus Osmunda, but preferred describing it as an Osmundites, under the name of *O. Dowkeri*. The specimen was silicified, and the author stated that even the starch-grains contained in its cells and the mycelium of a parasitic fungus traversing some of them were perfectly represented. Its precise origin was unknown: it was said to be probably derived from the London clay, or from the beds immediately below.

Discussion.—Mr. W. W. Smyth, in calling on those present for remarks on the paper, commented on the very remarkable manner in which the minutest details of the original plant had become silicified.

Mr. Etheridge mentioned the discovery of fossil fern-stems of somewhat similar character at Bromsgrove.

Professor Ramsay suggested the possibility of the fossil having been derived from a bed even higher than the Thanet Sands. He thought the rarity of such delicate structures being perfectly preserved by silification not so great as might at first sight appear, for in Antigua and elsewhere vegetable forms had been converted into flint as completely and distinctly.

Mr. Woodward cited the hot springs in the island of St. Michael as converting portions of vegetables still growing into flint. He had heard of the ends of piles being converted into flint in the course of thirty years, but had not yet seen them.

Mr. Jenkins inquired whether the Osmundæ from different formations offer any evidence of the climate under which they lived. He thought that where vegetable structures were perfectly preserved in flint, the process of silicification had gone on but slowly: but this fell more within the province of the chemist than of the geologist.

Mr. Hulke suggested the possibility of the fern having contained a certain amount of silica while still living.

Professor Morris referred the fossil to the Thanet Sands. He thought that the silica in fossil coniferous and endogenous wood varied in character, and this might throw some light on the process of conversion. He considered that objects containing phosphate of lime, and those containing carbonate, were subject to different processes of silicification.

Mr. Whitaker was strongly of opinion that the fossil had been derived from quite the upper part of the Thanet Sands.

Professor Duncan called attention to the process of silicification as exhibited by the Antiguan corals, in which one highly-insoluble mineral had been replaced by another almost as insoluble.

Mr. Carruthers, in reply, did not think that anything could be predicated as to climate from extinct species; if this were attempted, a similar error to that with regard to the climate under which the fossil elephants were supposed to have lived, might be repeated. Existing Osmundaceæ contained no silica in their structure. The peculiarity of the fossil under consideration was the preservation of the contents of the cells, even to the starch, which is so readily decomposed. The difficulty of accounting for the replacement of soft vegetable matter by hard mineral silica, seemed to him great.

"On the Oolites of Northamptonshire," by Samuel Sharp, Esq., F.G.S.—The author stated that his ultimate purpose was to describe severally the Oolitic beds occurring in the Northampton district, in the more northerly parts of the county, and in the neighbourhood of Stamford; to exhibit fossils gathered from each locality, and to correlate the several series, and thus to endavour to establish the character and sequence of the Oolites of this Midland district. He anticipated, however, that the publication by the Geological Survey of their maps and memoir of North Northamptonshire (the work of Mr. Judd) would intervene, and might render superfluous the carrying out this work in its entirety; but in the mean time he submitted his first part, "The Oolites of Northampton and Neighbourhood."

The author stated that there were four areas within a comparatively small space in which the whole of the beds occurring in each, from the Great Oolite down to the Upper Lias (inclusive), were accessible. These were situated at or about—1. Kingsthorpe; 2. Northampton; 3. Duston; 4. Blisworth. The Oolitic beds in these several areas were described in detail, the beds of the Northampton Sand (as comparatively little known) being those to which the greatest interest attached. These he proposed to class in three divisions—the "Upper," the "Middle," and the "Lower" Northampton Sand.

The individual beds of the several localities were shown to vary considerably; but collectively they would present the following general section, the maximum thicknesses being given in feet:—

Great Oolite.		A. White limestone, disposed in beds of from a few inches to about 3 ft. in thickness, much fissured, and varying in character, and containing characteristic Great Oolite fossils	25
		B. Blue and grey clay, dug for brick-making, with a ferruginous band at base, and Great Oolite fossils	15
		[Line of unconformity.]	
Inferior Oolite.—Northampton Sand.	Upper.	C. White or grey sand, more or less coherent, and with occasional ferruginous stains, sometimes quarried for building-stone. A plant-bed is usually found in this sand	12
	Middle.	D. A series of very variable beds, composed sometimes of ferruginous sandstone in thin layers, which overlie calcareous beds containing shelly zones, false bedding being frequent. Sometimes the whole section consists of calcareous rock with false bedding, sometimes it presents a series of beds of compact ferruginous sandstone with no fossils. In one instance the entire section consists of white sand and sandstone, with no fossils	30
		Coarse Oolitic or subcrystalline limestone, with fossils, overlying a calcareo-arenaceous slate, like Colleyweston Slate	4
	Lower.	E. Beds chiefly consisting of Ironstone, containing *Rhynchonella variabilis* and *R. cynocephala*, and *Ammonites bifrons* at the base	35

This general section, the author stated, might be accepted as a typical section of a considerable portion of the county of Northampton.

In his concluing remarks the author referred to the great limestone which marked the country about Stamford, and, traversing Rutland, attained its greatest thickness in Lincolnshire. This limestone was proved by its palæontological contents to be Inferior Oolite; and its place, with reference to the beds described in the paper, was shown to be in the interval (marking the line of unconformity) between B and C of the general section. It thus tended to confirm the statement of the author that the line of division between the Great and the Inferior Oolite in the neighbourhood of Northampton occurred at that point.

The paper was illustrated by the exhibition of a large collection of fossils from the several areas, including some new species, prominent among which was a new Starfish, named, in compliment to the author, *Stellaster Sharpii*, by Dr. Wright, F.R.S.E., F.G.S., and described by him in a note appended to this paper.

Discussion.—Mr. Smyth commented on the great value of careful observations by local geologists, such as those brought before the society by Mr. Sharp.

Mr. Etheridge pointed out how a few years ago it was supposed that hardly a fossil was to be found in these Northampton Beds, and that they all belonged to the Great Oolite, and not to the Inferior, an error in which the Geological Survey had shared. The district was, however, now being resurveyed under the new light thrown on the character of the rocks by the extensive quarrying which had taken place during the last few years, and which had afforded the opportunities so judiciously utilized by the author of the paper, who had placed the order of succession and the character of the Northampton Beds beyond dispute.

Prof. Morris had found a difficulty in reconciling the phenomena of the eastern and western Oolitic areas, but considered that the key of the arrangement was to be sought in the district between Northampton and Stamford.

Mr. Sharp briefly replied.

The following specimens were exhibited:—A Fern-stem from Herne Bay, exhibited by W. Carruthers, Esq., F.L.S., F.G.S. A Collection of Fossils from the Northamptonshire Oolites, exhibited by Samuel Sharp, Esq., F.G.S.

ZOOLOGICAL SOCIETY.

March 10th.—John Gould, Esq., F.R.S., V.P., in the chair. The secretary spoke of the additions to the society's menagerie during the month of February, amongst which were particularly noticed a collared fruit-bat (*Cynonycteris collaris*), born in the society's monkey-house on the 25th inst., being the first instance on record of a birth amongst these animals in captivity, and a kangaroo, believed to belong to a new species, for which the name *Macropus erubescens* was proposed.

Professor Flower exhibited a drawing of a cetacean animal lately captured in a mackerel-net off the coast of Cornwall, which he identified with *Globiocephalus rissoanus*—a species hitherto only known to occur in the Mediterranean. The specimen was stated to be an adult female about 11 ft. long.

Mr. Sclater gave some additional details as to the correct locality of Amherst's pheasant (*Thaumalea Amherstiæ*) in reference to Mr. Swinhoe's communication on the same subject at the previous meeting.

Professor Owen read a memoir containing descriptions of various bones of *Aptornis defossor*, *A. otidiformis*, *Notornis Mantelli* and *Dinornis curtus* obtained from deposits in different parts of New Zealand, and forming the fifteenth part of his series of memoirs on the extinct birds of the genus Dinornis and their allies.

Mr. R. Swinhoe, F.Z.S., read three papers on new or little known birds obtained by him in different parts of the Chinese Empire. The first of these related to new species obtained during a recent voyage up the Yangtze, amongst which were species of Parus, Lanius, Ægithalus, and other genera of Passeres. The second contained supplementary remarks on the Pied Wagtails (Motacillæ) of China, in continuation of a former paper on the same subject. The third paper contained a notice of the different species of Shore-plovers (Ægialitis) found in China, amongst which was a conspicuous new species obtained on the Yangtze, and proposed to be called *Ægialitis Hartingi*.

Mr. R. B. Sharpe read the second of a series of papers "On the Birds of Angola," containing an account of collections forwarded from that country by Mr. Monteiro. Amongst these was a Bush-Shrike belonging to the genus Laniarius, supposed to be new, and proposed to be called *Laniarius Monteiri*.

Dr. Günther read a note on the locality of the Batrachian recently described by him as *Megalixalus robustus*, which was stated to be from the Seychelles.

Dr. Günther read a paper on the genus Prototroctes, which contains two species of fishes from the fresh-waters of Southern Australia and New Zealand. In general appearance these fishes resemble Coregonus, but their internal structure had led Dr. Günther to constitute them along with the South American genus Haplochiton a distinct family, Haplochitonidæ, which appeared to be the representative of the Salmonoid group in the southern hemisphere.

A communication was read from the Rev. O. P. Cambridge containing descriptions of three new species of Arachnida of the genus Idiops in continuation of a former paper on the same subject.

ANTHROPOLOGICAL SOCIETY OF LONDON.

March 15th.—Dr. Charnock, V.P., in the chair. William Stephens Haywood, Esq., Long Wittenham, near Abingdon, Berks; and P. Henderson, Esq., her Majesty's Vice-Consul at Benghazi, North Africa, and No. 1, Stafford-place, Buckingham-gate, were elected fellows. Dr. Daniel Earl Burdett was elected a local secretary for Belleville, Ontario, Canada.

The following paper, by Dr. Isidore Kopernicky and Dr. J. Barnard Davis, F.R.S., was read:—"On the Strange Peculiarities observed by a Religious Sect of Moscovites, called Scoptsi."—This curious Christian sect of a well-defined race was fully described in the paper by Dr. Barnard Davis from data supplied him by Dr. Kopernicky of Bucharest, and it was accompanied by an anatomical preparation which clearly demonstrated the character and amount of mutilation practised by the Scoptsi. That practice is based upon the twelfth verse of the nineteenth chapter of St. Matthew, and it has been carried out with such resolution, and to so large an extent, that the Russian Government has been compelled to interfere and to punish with extreme severity all members proved to belong to that community.

Hence, the Scoptsi are forced to conduct their worship and to carry out their peculiar rites in the most secret manner: nevertheless, they contrive to amass great wealth, and as a consequence they possess considerable influence in districts in which they reside. Accident alone brought under the notice of Dr. Kopernicky the case of the individual whose body furnished the preparation laid before the society. The paper, after entering at length into the modes of conducting the religious worship of the Scoptsi, their estimated numbers, their physical characteristics and other details, viewed the subject in its psychical aspect. Dr. Kopernicky was of opinion that this aberration in Christianity could not be explained otherwise than by the psychological peculiarity of the race of Moscovites in which it prevails. He endorsed the well-known views of the Rev. Dunbar Heath upon the difference which exists between the Semitic and "Aryan" races in their appreciation of the doctrines of Christianity, and held it to be an anthropological fact that the ideas and religious creeds, sound or absurd, moral or immoral, which are produced or develop themselves among a certain race, depend greatly upon the character of the psychological sentiments natural to that race. That was the reason why Christianity was so readily accepted, and has taken such root among the Aryan peoples, and why on the contrary, the Koran has had most success and most persistence among the Semites. An animated discussion ensued, in which the Rev. Dunbar Heath, Mr. Moncure Conway, Mr. Ralston, Dr. Spencer Cobbold, and others, took part.

ENTOMOLOGICAL SOCIETY OF LONDON.

March 7th.—Mr. F. P. Pascoe, vice-president, in the chair. The Rev. Richard P. Murray, and M. J. C. Pols, were elected members. Numerous objects of interest were exhibited by Professor Westwood, Rev. H. S. Gorham, Dr. Wallace, Messrs. Albert Müller, Janson, Butler, and Stainton. Dr. Wallace addressed the meeting on the progress and prospects of sericiculture in this country and the colonies. Prof. Westwood read "Descriptions of Twelve New Exotic Species of the Coleopterous family Pselaphidæ."

ROYAL GEOGRAPHICAL SOCIETY.

At the usual meeting of this society on Monday evening week, the president, Sir Roderick Murchison, read an official letter he had that day received from Lord Clarendon, stating that a severe outbreak of cholera had occurred in East Africa, at Zanzibar, and in the neighbouring mainland, which it was feared would delay the progress of Dr. Livingstone, inasmuch as the native carriers who were taking supplies to him had been attacked by the epidemic. Sir Roderick stated that there was little probability of the disease reaching the remote interior district, where Livingstone remained waiting for the Zanzibar caravan.

The paper of the evening was "On Morrell's Antarctic Voyage and on the advantages of Steam Navigation in future Antarctic Explorations," by Captain R. V. Hamilton, R.N.—According to the author a remarkable narrative of a voyage in high southern latitudes by Benjamin Morrell, in a sailing schooner, published at New York in 1834, had been hitherto overlooked by all concerned in Antarctic exploration. Even Morrell's celebrated countryman, Commodore Wilkes, seems not to have been aware of this publication, which appeared before he sailed on his voyage of discovery. Captain Hamilton had laid down Morrell's route on a South Polar chart, and found that it intersected several times the land said afterwards to have been discovered by Wilkes. The portion of the Antarctic Ocean navigated was between 66° and 70° 14′ S. latitude and between 105° E. longitude and the meridian of Greenwich. South of 64° he found less ice, and in 69° 11′ S. there was no field ice visible. Captain Hamilton concluded that the Antarctic lands seen by Wilkes and others were mostly islands, and that one or other of them would offer a suitable site for the observation of the approaching transit of Venus. The employment of steam-vessels, he contended, would add very greatly to the safety of the expedition as well as the facility of reaching the high southern latitudes. The great barrier of ice surrounding the South Polar lands he believed was not glacier ice, but an enormous floe.

In the discussion which followed, Commander J. E. Davis (of Sir James Ross's expedition) dissected many of Morrell's statements about well-known places in high southern latitudes, and showed that they were almost all pure fiction; he considered his work to be, therefore, of no authority, and denied that it had been overlooked. It had been examined by chartographers and writers, and set aside as unreliable. Mr. Enderby expressed similar opinions, from personal knowledge of Morrell; and Mr. F. Galton also exposed Morrell's inaccuracy with regard to the interior of south-west Africa. Captain Sherard Osborn differed in opinion from Captain Hamilton regarding the formation of the Antarctic icy barrier, and believed it to be the seaward edge of an enormous continental glacier. Admiral Ommanney also took part in the discussion.

The following new members were elected:—Charles Ashton, William J. Anderson, Louis Alford, Charles Fairbridge, Charles W. Gray, Edward Gellatly, J. G. Gibson, T. D. Murray, Rev. W. R. Tilson Marsh, M.A., M. le Chevalier de Overbeck, Robert T. Pigott, Albert Walker, Thomas Watson, and Peter T. Wills.

GEOLOGISTS' ASSOCIATION.

Ordinary Meeting, March 4th.—C. T. Richardson, Esq., M.D., vice-president, in the chair.

A paper was read by Caleb Evans, F.G.S., entitled "Additional Notes on the Railway Sections at Sevenoaks."—The author described in detail the various deposits passed through in constructing the tunnel (3,451 yards in length), and on the range of hills on which Sevenoaks is situated, and the sections seen in the cuttings to the north of that tunnel.

The lowest beds traversed by these works are of fresh-water origin, are only seen in the neighbourhood of Sevenoaks Weald, and consist of grey, blue, and greenish clays, with many layers of flattened bivalve shells of the genera Unio and Cyrena. Many of the layers are studded with great numbers of Cyprides mostly as casts in the clay. Detached fish-scales are dispersed throughout this group of beds, the rhomboidal scales of Lepidotus being the most abundant.

Finely-preserved specimens of the palates of fishes exhibiting two or three different kinds of crushing teeth, and also reptilian and other vertebrate remains have been here obtained.

At the bottom of shaft No. 3, at a depth of 127 ft. from the surface, is a band, about 2 ft. thick, of hard Sussex marble, consisting almost entirely of the shells of Paludina, and occasionally of Cyrena. A few scales, palates, and other fish-remains are met with in this rock.

A short distance above this band of limestone, beds of green, buff, and brown clays set in. Some of these clays are excessively hard and dry, almost approaching to a slaty character. Fossils are rare in these beds, but a few specimens of this have been met with at the shafts on Sevenoaks Common. At the top of the hill higher beds of the Weald clay are seen, in which the numerous bands of Unio give place to layers of Cyrena.

In this portion of the series there are many concretionary masses, containing seams, often thin, but occasionally two or three inches thick, composed almost entirely of the valves of Cyrena,—the shells in some blocks being of large size, in others smaller and associated with a small turreted shell. In some blocks are layers of a small Paludina. Others present surfaces studded with the shell-cases of *Cypridea tuberculata* in a fine state of preservation.

Detached scales, vertebræ and spines of fishes are plentifully dispersed throughout most of these concretions, and in one of these Mr. Bott found a beautiful specimen of Lepidotus. A large block of stone from this part was observed by the author presenting on the surface a well-defined outline of a turtle. The bones unfortunately were much broken. The specimen was depressed and elliptical in form, about a foot in its longest diameter, and the surfaces of the bones were smooth.

The highest bed of the Weald clay consists of a dark, almost black clay, which shows the first transition from fresh-water to marine conditions, the prevailing fossils in it being Cerithia or Potamides, and with them are associated an oyster, a Cardium, and a few other shells of an estuarine or marine character.

The succeeding bed is a dark greyish-coloured sandy clay, which gradually passes, by the loss of argillaceous matter, into a dark clayey sand, and this upper portion contains a vast amount of water, which was the source of much difficulty to the excavators.

These beds contain concreted masses of large size, and abounding with shells. The most conspicuous and abundant fossil in the concretions is the *Perna Mulleti*. A large oyster, or Gryphæa, is also very common. Many other shells, chiefly bivalves, are present both in the concretions and in the softer portions of the bed, nearly all agreeing with those given in the published lists of the fossils of the lower beds of the greensand, at Atherfield. Among the most abundant are *Corbula striatula, Arca Raulini, Myacites plicata, Nucula scapha, Terebratula sella,* and *Trigonia caudata*. The thickness of these "Atherfield beds" is estimated at about 50 ft.

The dark-coloured beds are succeeded by the Kentish Rag series, consisting of alternations of hard bands of limestones, sandstones, and chert, with the softer Hassock stone.

The relation of the upper portion of the lower group to the Kentish Rag, or "Hythe series," is well seen in the cutting at the northern mouth of the tunnel. The direction of the cutting at this point is from N.W. to S.E., and is not quite in the direction of the dip of the beds, which is nearly south. The lower part of this cutting consists of the sandy Atherfield bed, of a dark blue colour, above which the Kentish Rag series appears rising from the south at an angle of about 25°. The bands of stone being of a yellowish or ochreous tint, the marked difference in colour between them and the blue Atherfield bed renders the junction very conspicuous. The outcrop of the softer lower series occupies a small irregular valley between the hills, but at a short distance from the mouth of the tunnel the blue bed is suddenly cut off by a very conspicuous fault, on the north side of which the Ragstone beds again appear, and are seen in the sides of a deep cutting. They are here nearly horizontal, but are somewhat turned up and rubbly at the line of contact with the fault. On the east side of the cutting the section is somewhat different. The stone beds rise at a steep angle from the mouth of the tunnel, but the lower layers before reaching the surface of the country are suddenly bent down at a sharp angle to the north, and after dipping for a short distance curve round to the surface near the lowest ground of the valley. The stone beds also curve up to the surface on the north side of the fault, but soon become horizontal.

The Ragstone series consists of about 20 bands of stone, separated by softer bands of sandstone with green grains, known as Hassock. The beds become more sandy in the upper portion of the section. The Ragstone beds are about 100 ft. thick.

The fossils of the Kentish Rag group are found, for the most part, in the Hassock. The most abundant are *Lima Cottaldina*, D'Orb., and *Trigonia spinosa*, var., Sow. (*T. ornata*, D'Orb.). *Terebratella oblonga*, Sow., and a Plicatula are occasionally found.

After crossing a valley the line, near Riverhead, cuts through another ridge entirely composed of the highest portion of the Lower Greensand, consisting of yellow and ferruginous sands, with no trace of stone except irregular bands and veins of pebbly ironstone, and devoid of fossils; and the line then passes over the broad valley of the Gault.

In conclusion, the author noticed the conditions under which the Sevenoaks deposits had been formed, and also the British and Foreign equivalents of the beds.

An animated discussion followed the reading of the paper, in the course of which the numerous dislocations to which the rocks of the neighbourhood had been subjected were mentioned, and the difficulties attending any attempts to restore the land areas of these past epochs were alluded to.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, February 22nd.—J. P. Joule, D.C.L., LL.D. F.R.S., &c., president, in the chair. The president referred to the observations he had made in former years on the progressive rise of the freezing point of one of his thermometers, published in the *Proceedings* for April 16, 1867. He had made a further observation on the 12th February instant, and found that a rise, which though very small was unmistakable, was still taking place after a lapse of time of 26 years since the bulb was blown. The results are as follow in indications of the thermometer, calling the first observation in April, 1844, zero. 12·9 divisions of the thermometer correspond to 1° Fahrenheit.

April, 1844	0	December, 1860	11·1
February, 1846	5·5	March, 1867	11·8
January, 1848	6·6	January, 1868	11·92
February, 1853	8·8	February, 1870	12·02
April, 1856	9·5		

Dr. F. Crace Calvert, F.R.S., stated that he did not intend to read a paper on Artificial Alizarine, some of the facts he was going to bring before the notice of the meeting, being well known to his colleagues the chemists of this district, but he hoped it might be interesting to the general members of the society to have an idea of the progress that had been made during the last few months in the production of this substance. He then gave an interesting historical sketch of the subject.

"On the Organic Matter of Human Breath in Health and Disease," by Dr. Arthur Ransome, M.A.—The vapour of the breath was condensed in a large glass flask surrounded by ice and salt, by which a temperature of several degrees below zero was obtained. The fluid collected was then analyzed for free ammonia, urea, and kindred substances, and for organic ammonia—the method employed being that invented by Messrs. Franklyn and Chapman for water analysis.

The breath of 11 healthy persons and of 17 affected by different disorders was thus examined, and the results were given in two tables.

The persons examined were of different sexes and ages, and the time of the day at which the breath was condensed varied.

In both health and disease the free ammonia varied considerably, and the variation could not be connected with the time of the day, the fasting or full condition. Urea was sought for in 15 instances—three healthy persons and 12 cases of disease—but it was only found in two cases of kidney disease, in one case of diphtheria, and a faint indication of its presence occurred in a female suffering from catarrh.

The quantity of ammonia, arising from the destruction of organic matter, also varied, possibly from the oxidation of albumenous particles by the process of respiration; but in healthy persons there was a remarkable uniformity in the total quantity of ammonia obtained by the

process. Amongst adults the maximum quantity per 100 minims of fluid was 0·45 of a milligramme, and the minimum was 0·35.

A rough calculation was given of the total quantity of organic matter passing from the lungs in 24 hours—in adults about 3 grs. in 10 oz. of aqueous vapour, a quantity small in itself, but sufficient to make this fluid highly decomposible, and ready to foster the growth of the germs of disease.

In disease there was much greater variation in the amount and kind of organic matter given off.

In 3 cases of catarrh, 1 of measles, and 1 of diphtheria, the total ammonia obtained was much less than in health—less than 0·2 of a milligramme—a result probably due to the abundance of mucus in those complaints, by which the fine solid particles of the breath were entangled.

In two cases of whooping-cough it was also deficient, but as they were both children, the lack of organic matter may have been due to their age.

In cases of consumption also the total ammonia was less than in health; but in one case of this disease associated with Bright's disease a large amount of organic matter was given off, a portion of it due to urea.

In kidney diseases the largest amount of organic matter of all kinds was found in the breath, the ammonia in one case of Bright's disease was 1·8 milligrammes in 100 minims of fluid, and urea was largely present. Perhaps this fact might be taken as an indication of the need of measures directed to increase the activity of other excretory organs.

In one case of ozona or offensive breath the total quantity of ammonia obtained was greater than in any healthy subject, but the excess was chiefly due to organic matter.

One convalescent case of fever was examined, and the total ammonia was found to be deficient.

The air of a crowded railway carriage, after 15 minutes' occupation, was also tested by this method and in about 2 cubic feet 0·3 milligramme of ammonia and 3 milligrammes of organic matter were found.

With reference to the presence of organic matter in the atmosphere, it was pointed out that the subject was in no way a novel one, and that it had, during the last thirty years, been very fully investigated by many observers, more especially by Schwann, Dusch, Schroeder, Helmholtz, Van den Broeck, Pasteur, and Pouchet; but it was shown that it is to Dr. Angus Smith that we owe the discovery of the readiness with which living organisms are formed in the condensed breath of crowded meetings, and the determination of the actual quantity of organic matter in the air of different localities.

Mr. Dancer's calculation of the number of spores contained in the air was noticed, but a source of error was pointed out in the readiness with which organisms are developed in suitable fluids, even in the course of a few hours. Observations upon the organic particles of respired air had at different times been made by the author.

1. In 1857 glass plates covered with glycerine had been exposed in different places and examined microscopically. Amongst others in the dome of the Borough Gaol, to which all the respired air in the building is conducted, organized particles from the lungs and various fibres were found in this air.

2. During a crowded meeting at the Free Trade Hall air from one of the boxes was drawn for two hours through distilled water, and the sediment examined after thirty-six hours. The following objects were noted:—fibres, separate cellules, nucleated cells, surrounded by granular matter, numerous epithelial scales from the lungs and skin.

3. The dust from the top of one of the pillars was also examined, and in addition to other objects, the same epithelial scales were detected.

4. Several of the specimens of fluid from the lungs were also searched with the microscope. In all of them epithelium in different stages of deterioration was abundantly present, but very few spores were found in any fresh specimen. On the other hand after the fluid had been kept for a few hours myriads of vibriones and many spores were found.

In a case of diphtheria, confervoid filaments were noticed, and in two other cases, one of measles and one of whooping-cough, abundant specimens of a small-celled torula were found, and these were seen to increase in numbers for two days, after which they ceased to develop.

These differences in the nature of the bodies met with probably show some difference in the nature of the fluid given off; but it was pointed out that they afford no proof as yet of the germ-theory of disease. They simply show the readiness with which the aqueous vapour of the breath supports fermentation, and the dangers of bad ventilation, especially in hospitals.

Dr. E. Lund and Dr. H. Browne stated that they had also made experiments, the results of which were, in general, confirmatory of those obtained by Dr. Ransome.

NORTH STAFFORDSHIRE NATURALISTS' FIELD CLUB.

A REUNION of the members of this club, being the third meeting of the winter season of 1869-70, took place on Thursday, the 24th ult., in the Assembly-room, at the Red Lion Hotel, Leek. About twenty of the members resident in the Potteries and Newcastle went by train to Leek in the afternoon, and were joined on arriving by the Leek members and their friends, making together a party of seventy or eighty ladies and gentlemen. The Leek members, as on former occasions, gave evidence of the warm interest which they take in the success of the club, by collecting and displaying a larger and more interesting variety of objects than had ever been previously exhibited at any meeting of the association. The following were amongst the principal contributions:—Mr. Sleigh sent an original life-size portrait of Rousseau, presented by the philosopher himself to Mr. Sleigh's great-aunt, with whom he had established an intimate acquaintance; and also an old and probably contemporarary portrait of Oliver Cromwell. The committee of the Mechanics' Institution lent a fine line-engraving portrait of the first Earl of Macclesfield, "silver-tongued Parker," of whom, we observe, Mr. J. Sleigh says in a recent number of the *Reliquary*—By the verdict of Lord Campbell and others equally competent to judge, he was more unfortunate than criminal in his fall—more sinned against, in fact, than sinning." Pictures were also lent by Dr. Heaton, Mr. W. S. Brough, and others, and in this class of objects was a copy of the earliest published map of Staffordshire, dated 1577. Mr. T. Wardle, F.G.S., lent a splendid collection of the fossils of the mountain limestone, and of specimens of Derbyshire marbles. The excellence and variety of the latter took many by surprise, who were already aware to some extent of the beauty of the Derbyshire limestones. Mr. J. Ward, of Longton, forwarded a selection of the fish fossils of the North Staffordshire coalfield, and Mr. W. Molyneux, F.G.S., specimens of fossils recently discovered by him in the Rhœtic beds of Needwood Forest, on which in the course of the evening, he read an abie paper. Mr. W. Challinor contributed two illuminated MS. missals, an early edition of Shakespeare, and a number of remarkably fine Italian photographs. Scarce and valuable books, including *Pott's Staffordshire*, *Shaw's Staffordshire*, *Fuller's Worthies*, *Evelyn's Silva*, &c., were lent by Mrs. Alsop, Mr. Redfern, Mr. R. Mountfort, Mr. W. S. Brough, and others. Several high-class microscopes were lent by Messrs. Dancer, of Manchester, Mr. Garner, F.L.S., Mr. W. Challinor, and Mr. A. Cooper; a fine buzzard and other rare birds by Mr. Deussen; and an electrical machine by Mr. Wardle, who by the kindness of Messrs. Mottershead, of Manchester, was enabled to illustrate the brilliant effects produced by Geissler's vacuum tubes.

Mr. Wardle was voted to the chair, and opened the proceedings by reading on behalf of Mr. S. Carrington, of Wetton, who was too unwell to attend the meeting, a paper entitled "Notice of some Interesting Discoveries in a Cleft in the Mountain Limestone at Narrowdale."—It appears that in September, 1862, Mr. Carrington, whilst prosecuting his researches in the palæontology of the mountain limestone, came upon a curious cleft in the rocks at Narrowdale, near Alstonefield. This cleft was filled with blue limestone, which had been acted upon by great heat, and in which were imbedded a large variety of fossils, some of which were interesting from their rarity. After reading the paper, the chairman remarked that Mr. Carrington had been a most earnest and successful collector of fossils of the mountain limestone, and he had drawn up a list, printed copies of which would, by the kindness of the secretary of the Leek Branch of the Club (Mr. W. S. Brough), be distributed to the members in the course of the evening. This table showed that there were no less than 676 species of fossils, exclusive of varieties, in the mountain limestone.

Mr. J. Sleigh, author of the *History of Leek*, read a paper, in which he said he had embodied a few facts of local interest which he had collected since the publication of the History.

Mr. Molyneux, in his paper on "The Rhœtic Beds of Needwood Forest," said students of the older school of geology were taught that there was but one step between the red or saliferous marls of the New Red Sandstone to the blue lias of the oolitic series, but within the last six or seven years it had been ascertained that the old lias zone must be removed higher up in the crust of the earth, and based not on the New Red Sandstone, but on a series of intercalated deposits containing evidence sufficiently important to determine a new phase in geological demaracation. The strata to which the term rhœtic had been applied did not possess so marked a difference in their petralogical or in their palæontological aspect from the succeeding liassic group, but they had more than ordinary interest, as they embodied facts of a peculiar description. They were contemporaneous, so to speak, with the advent of a new creation of organic beings, not only generically and specifically different from those by which they were preceded, but evidencing by their numbers, their widespread distribution, and their nature, the dawning upon a long dark night of barrenness and waste of another bright and fruitful day of busy increase and replenishing.

Cordial votes of thanks were passed to the chairman, the readers of papers, and the Leek members for the great trouble they had taken.

BELFAST NATURAL HISTORY SOCIETY AND NATURALISTS' FIELD CLUB.

At a meeting of the society, held at the museum, on Wednesday, the 23rd of February, Prof Wyville Thomson F.R.S., president, in the chair Dr. Andrews gave an account of his researches on the continuity of the gaseous and liquid states of matter. In the introductory remarks he referred briefly to the views of the ancients regarding the constitution of matter, more particularly of the epicurean school, as expounded by Lucretius, to the discovery of the weight of the atmosphere by Galileo; to the doctrine of latent heat, as expounded by Black; and to Dalton's able investigation of the properties of vapours. The lecturer then described, in detail, the five experiments by which Faraday succeeded in reducing to the liquid state a large number of bodies, previously known only in the form of gases. The first experiments of the lecturer were published in 1861, and the apparatus employed was exhibited to the meeting, and applied to the condensation of carbonic acid gas. This apparatus was constructed by W. J. Cumine, to whose good ability and rare mechanical skill Dr. Andrews referred in the highest terms. He remarked, indeed, that in the difficult investigation in which he had been engaged he considered himself as favourably situated in Belfast, with this able mechanic, as if he had been working in any one of the great scientific centres of Europe.

In the early experiments with this apparatus, oxygen, nitrogen, carbonic oxide, and nitric oxide, were reduced by the combined action of cold and pressure to less than 1-500 of their ordinary volume, but without exhibiting any evidence of being liquefied. Two years later the remarkable observation was made, that when carbonic acid is partially liquefied by pressure, and the temperature gradually raised to about 88° Fahr., the surface of demarcation between the liquid and gas becomes fainter, loses its curvature, and at last disappears. The space is then occupied by a homogeneous fluid, which exhibits, when the pressure either suddenly diminished, or the temperature slightly lowered, a peculiar appearance of moving or flickering striæ throughout its entire mass. At temperatures above 88° no liquefaction of carbonic acid, or separation into two distinct forms of matter, can be effected, even when a pressure of 250 or 300 atmospheres is applied Dr. Andrews then proceeded to describe his recent investigations, which form the subject of the Bakerian lecture of 1869, and will be published in the *Philosophical Transactions of the Royal Society of London.*

After stating the experimental results, he proceeded—We are now prepared for the consideration of the following important question—What is the condition of carbonic acid when it passes at temperatures above 88° from the gaseous state down to the volume of the liquid, without giving evidence at any part of the process of liquefaction having occurred? Does it continue in the gaseous state, or does it liquefy? or have we to deal with a new condition of matter? The answer to this question, according to the results of the experiments, is to be found in the close and intimate relations which subsist between the gaseous and liquid states of matter. The ordinary gaseous and ordinary liquid states are, in short, only widely separated forms of the same condition of matter, and may be made to pass into one another by a series of gradations so gentle that the passage presents nowhere any interruption or breach of continuity. From carbonic acid as a perfect gas to carbonic acid as a perfect liquid, the transition may be accomplished by a continuous process, and the gas and liquid are only distant stages of a long series of continuous physical changes. These properties are not peculiar to carbonic acid, but are true of all bodies which can be obtained as gases and liquids. Nitrous oxide, hydrochloric acid, ammonia, sulphuric ether, and sulphuret of carbon, all exhibit critical points of temperature, beyond which pressure alone is incapable of producing two distinct physical conditions of matter in presence of one another.

In conclusion, Dr. Andrews referred to the fine discovery made many years ago by Professor James Thomson of the influence of pressure on the temperature at which liquefaction occurs; and stated that, in his opinion, this discovery pointed to the direction which future investigations must take, with the view of resolving the difficult problem of the possible continuity of the liquid and solid states of matter.

MONTREAL NATURAL HISTORY SOCIETY.

THE first of the Somerville course of popular lectures, in connection with the Natural History Society, was delivered on Thursday, the 10th ult., by Professor Bell, C.E., the subject being "Explorations in the Nipigon Country." The lecture-hall was completely filled, mostly by gentlemen who took a deep interest in the subject.

The lecturer regarded the extensive possessions of the British Crown, comprised within the Hudson's Bay territory, as destined soon to be largely explored, now that they are about to be transferred to Canada for the purpose of settlement. The explorations of which he was about to speak had been carried on in connection with the geological survey at the threshold of that vast country. Last autumn, when a few of the main results of the expedition had become known, some surprise had been expressed that so large a lake and so fine a country, lying, too, so close to Lake Superior, should have remained almost unknown up to that time. But this was only one of many of the wonders of our North-West Territory, of which equally little was known.

The lecturer referred to a great mistake which has become almost chronic in the popular mind, namely, that because certain mountains and bold headlands may be seen from the deck of the steamer in sailing along our side of Lake Superior, therefore the whole region, to an indefinite distance north, must be mountainous. Hitherto, writers on the subject of a Pacific railway through British territory had been in the habit of speaking of a "rocky barrier" in the Nipigon country. The lecturer had traced a course of a hundred miles in length past this country, which appeared as if it had been intended by nature for a railway route, so great were the facilities which it presented. It was next pointed out that the water flowed away from near the margin of Lake Superior, in all directions except that of the Nipigon country, which was regarded as a continuation of the Lake Superior basin. The Nipigon was the only large and only clear-water river entering Lake Superior, and might justly be considered the main St. Lawrence beyond this lake. Moreover, it was itself the outlet of a lake which deserved to be classified with the great lakes of the St. Lawrence. Besides being of great size, it received at least sixteen rivers and many smaller streams, altogether draining a very wide area.

Professor Bell regretted not being able to exhibit his large-scale map of the lake and rivers, as it was necessary first to present it to the Government, but he illustrated his lecture by a number of other maps and diagrams of the region and the country beyond. To give an idea of the great extent of Lake Nipigon he enumerated nine of the best known inland lakes, and stated that the area of Nipigon was more than four times as great, comprising about 3,700 square miles, or four-sevenths of the size of Lake Ontario. White men who had had an opportunity of visiting both of these lakes were inclined to regard them as of equal size, but this arose from the numerous large bays running off Lake Nipigon, giving an uncertainty as to its size until mapped from actual survey.

The lecturer then proceeded to give a narrative of the expedition under his charge, as being perhaps the best way of conveying an idea of the character and appearance of the lake and surrounding country. Nipigon differed from the other lakes in being studded throughout its entire extent by a great number of picturesque islands, some of them being very large, and the soil upon them generally good. Their varied appearance and grouping gave the landscape everywhere a charming appearance. The lake was the summer resort of a considerable number of Indians, who appeared to enjoy the solitude of this region and to live well, owing to the great abundance of fine fish. The Nipigon river, of which a description was also given, was said to afford the finest trout-fishing in Canada. Instances were mentioned of the rapidity with which news spreads amongst the Indians, and of the alarm caused them by a report that the survey was being made in order to deprive them of their lands, which they value very highly. In consequence of this report it was very difficult to get any of them to assist as guides.

Owing to the great size of the lake, it was necessary to divide the party into two sections, which separated at the south end, one taking the east, and the other the west side, and, at the close of the survey, they met at the northern extremity. The whole coast was carefully triangulated, and the positions of a large number of the islands fixed. The lower reaches of some of the rivers were surveyed, and found to pass through level tracts with deep soil on either side. The soil resulting from the decomposition of trap, like that of the Nipigon country, was always found to be rich and durable. The farm of the Hudson's Bay Company at Nipigon House, which is nearly a hundred years old, proved this. Large tracts had been swept by repeated fires, and were now covered by a luxuriant growth of nutritious grass. The climate appeared to be not unlike that of Montreal, and this fact, together with the good quality of the soil, would lead us to expect the whole region to be settled some day by an agricultural population.

The hour set apart for the lecture having almost expired, not much could be said in regard to the best route for opening up the great North-west territory. Prof. Bell, however, remarked that the route on which money was now being expended by Government was not intended for a railway, for which it offered great physical difficulties, besides running for a long distance upon the American boundary line—across one part of its course the Lake of the Woods stretched from the American territory to a distance of 70 miles north. By going round the north side of this lake a point would be reached close to the direct line which would pass through the Nipigon country. The surface features depended upon the geological structure, and both pointed to the Nipigon region as the true, if not the only, possible route for our through railway, and nothing less than this would satisfy modern demands and preserve the country to the British crown.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, MARCH 14TH.—The correspondence of the day was presented by M. Elie de Beaumont. One of the papers brought forward was a note by Dr. E. Decaisne, containing some remarks on the respective value of human and animal vaccine. The letter was of some length; the conclusion, however, at which the author arrived was to the effect that the new method of animal vaccination has no advantages over the old or Jennerian plan.

M. Dumas presented a paper in which the author made some remarks on the danger, in a hygienic point of view, which results from the miasmata derived from the air of hospitals. The author calls attention to the advisability of purifying the air expelled from hospital wards, either by means of heat or by some other process.

M. Dumas approved of this suggestion.

M. Henri Saint-Claire Deville remarked on this subject that, from experiments made by M. Pasteur upon air expelled from hospitals during the last cholera epidemic, it was observed that some portions of this air were acid, and some were alkaline, and that the presence of all kinds of spores had been remarked in it. M. Saint-Claire Deville thinks it would be advantageous to burn this air before it be expelled into the atmosphere.

General Morin observed that if, for the preliminary heating of this air it should be necessary to raise it to a temperature of from 400° to 500°, it would be a considerable expense.

M. Fremy, who also spoke, said he thought this operation of combustion of air to be in itself inconvenient.

M. Bouillaud observed, in support of the purification of air, that the smells in hospital wards are of very great value in a chemical point of view, as their presence is often the source of an epidemic.

M. Henri Saint-Claire Deville presented a work which forms the conclusion of the one which he presented some time ago. This work contains the results of experiments relative to the action of zinc upon mixtures of sulphuric, chlorhydric, and nitric acids. The author tries anew to establish that to interpret these results it is needless to have recourse to other forces than those already known.

M. Faye said he thought it advisable to recommend to observers the use of photography at the approaching transit of Venus, as he considered it both useful and easy for every one. He said that English astronomers seemed to prefer the Halley method, the Germans the Heliometric. M. Faye wished particularly that French astronomers might use the photographic method combined with the electric registration of time.

M. Charles Saint-Claire Deville observed that the sudden coldness of the atmosphere during the past few days had been preceded by an equally sudden change in barometric pressure. He remarked that in the bulletin of the Meteorological Observatory of Montsouris this change had been indicated as very probable.

M. Bouillaud presented a work by M. Lunier, Inspector-General of Lunatic Asylumns, on the increase signalized by statistics in the proportion of lunatics in France and the rest of Europe during the last forty years. In France, since 1835, the proportion has quintupled, but M. Lunier remarked that statistics are made out more carefully than formerly. Hence we can now register a greater number of lunatics than heretofore, nevertheless it is recognized that an increase has certainly taken place, and amongst the forms of madness more frequent now than hitherto, he observes among others that resulting from drunkenness. Cases of general paralysis, and softening of the brain, are as abundant now as in former years.

M. Combes presented a memoir, by M. Brunel, on steel containing phosphorus. The author disputes that the idea, the presence of phosphorus in steel effects an improvement in its quality, as Sir William Fairbairn has stated. A critical examination of the results obtained by the latter has led M. Brunel to the conclusion that the introduction of phosphorus is more injurious than useful, and that the resistance of the steel is not increased by it, as has been stated in England.

M. Wurtz presented a paper by M. Verneuil, upon a case where chloral succeeded in tetanus: ten grammes caused instant relaxation of the muscles. Another case in which the use of chloral seems to promise good results is still under observation.

M. Nélaton remarked that it should not be concluded from a single case that tetanus could be cured by chloral. Because it was an affection in which sometimes every remedy was effectual without being sovereign, and had in very many cases been relieved by the same remedies which at other times it resisted.

M. Alphonse Milne-Edwards, then read a paper on the birds of various parts of France, and particularly of Bourbonnais during the Middle Tertiary epoch. The abundant remains of these animals is very great, and M. Alphonse Edwards has already discovered more than sixty, amongst which are some which indicate that the climate of France at this period must have been as warm as that of Southern Africa. The principal representatives of the Tertiary ornithological races are the Parroquets, Ibis, Pelican, Secretaries, &c.

M. Maumené also read a paper in which he again protests against the theory of substitution, and against what he calls erroneous views recently brought forward by M. Wurtz in his last work on the synthesis of the aromatic acids. He tried to prove that the new facts of M. Wurtz are much better explained by his (M. Maumené's) theory than by M. Wurtz's.

The Academy then resolved itself into a secret committee.

ROYAL INSTITUTE OF LOMBARDY.

MILAN, JANUARY 27TH.—Signor Castiglioni presided for the first time, and delivered an interesting address.

Prof. Sangalli read a paper on a cause of Tortiocollis, as yet unknown.

Dr. Biffi then brought forward the results of some recent researches on inoculation of pulmonary tubercle which he had made in conjunction with Dr. Verga. This paper gave rise to some observations from Dr. Bizzozero, tending to show the apparent discord of results obtained in this matter by many experimenters; this opinion was confirmed in a few words by Dr. Verga.

Prof. Garovaglio read some critical notes on the *Placidiopsis grappæ*, a genus of Lichens discovered by Dr. Beltramini.

Dr. C. Lombroso made a communication on the preventive treatment of Pellagra.

The society then passed on to other affairs and to the election of members.

NOTES AND MEMORANDA.

Ironclads, Present and Future.—The following is a correct account of the paper on this subject read in the theatre of the United Service Institution on Monday fortnight by the author, Mr. Charles F. Henwood. The author stated that the country possessed in all but 47 ironclads, which had been divided by the Admiralty into no less than 13 different classes. Such a classification simply exhibited what a medley collection we possess. It had been stated by Sir William Fairbairn that "it is essential that the steam navy of this country should be able to manœuvre at sea with the precision of a squadron on parade." Our present ironclads were incapable of performing such evolutions, for their maximum speeds were too various—some 11 knots, and others 14 knots at sea; they also varied considerably in handiness, the long ships having small rudders, while the short ships have large rudders. In respect, therefore, of squadron evolutions, our present ironclad navy was not in a satisfactory condition. The reader pointed out defects of the six vessels of the *Audacious* class, especially noting the fact that their maindecks, which are only 4 ft. above the water, are protected simply by steel plating $\frac{6}{16}$ in. thick, covered with a wooden deck 3½ in. thick. The author further argued that the *Captain* was, on the whole, superior to either the *Hercules* or the *Monarch*, for although the *Hercules* was more strongly armour-plated at the water-line, her battery and other portions were inferior to the defensive powers of the *Captain*. The *Captain* and the *Monarch* are armed with four 600-pounders, and two 115-pounders, throwing a broadside of 2,515 lb., while the *Hercules* can throw but 2,080 lb. The *Captain* is 1,000 tons smaller than the *Hercules*, and 300-horse power less, and is 800 tons smaller than the *Monarch*, and 200-horse power less; and taking the same rate per ton and horse-power for each, the *Captain* would cost £62,800 less than the *Monarch*, and £77,220 less than the *Hercules*. The *Captain*, therefore, Mr. Henwood considers, takes her place at the head of all our sea-going ironclads, as the most powerful and at the same time the most economical. The *Devastation* and *Thunderer* are turret-vessels without masts or sails; they are to carry four 600-pounders in two turrets, which are surrounded by a breastwork invented by Captain Coles in 1865. The hull, breastwork, and turrets will be plated with 12 in. of solid iron; but these powerful and costly vessels will not be fast. Their estimated speed is but 12 knots. The speed of our earliest ironclads is 14 knots, which speed is now maintained by most of our Transatlantic steamers. The latest ironclad ordered, an improved *Devastation*, named the *Fury*, is estimated to have 13½ knots, but as the *Thunderer*, to be built at Chatham, is not yet laid down, it would be wise to reconstruct her and increase her speed from 12½ knots to at least 13½, the same as the *Fury*. The author further stated that it is more than probable that within the next two or three years we shall possess 1,000-pounder guns, for the Russian Government do already possess such a gun, weighing 50 tons, throwing projectiles of 1,000 lb. weight, with a charge of 130 lb. of powder. Again, it is possible that the hydraulic propeller may prove more suitable for ships of war than the screw, that liquid fuel may supersede coal for generating steam, and that an efficient plan for sheathing the bottoms of our iron ships with zinc may be discovered. Considering that these at present unsolved problems may and undoubtedly will, cause another reconstruction of our navy, in-

volving an expenditure of £12,000,000 or more, the author believes it most unwise to lay down at the present time new ironclads which will take two or three years to complete, at a cost of £300,000 apiece. But, having regard to the national necessity for increasing the number of our present ironclads—a necessity admitted by the Admiralty—we might convert the best of our screw line-of-battle ships into practically as good ironclad turret-vessels as the *Devastation*, which would involve but one-third the outlay in time and money. At the same time, a portion of the money thus saved might, with advantage to the country, be expended in making judicious and exhaustive experiments for solving the above questions. Thus should we secure real economy with efficiency.

Risso's Dolphin in British Seas.—We learn from a contemporary a female of "Risso's Dolphin" (*Grampus Rissoanus*), nearly 12 ft. long, was caught on the coast near Plymouth, on the 28th of February. The species appears to be nearly confined to the Mediterranean seas. There is on record only one instance of its having been found on this coast before, which rests on the authority of a skull discovered by Mr. Berry, which he sent to the British Museum. The animal has a very rounded head, with a very slight indication of a beak like the "globe-headed whale," *Globiocephalus svineval* (?),—a very high dorsal fin, and long, slender, sickle-shaped, pectoral fins. It is of a grey and white mottled appearance, with a number of scratches in various directions on the surface. The animal was sent to the Columbia Market, and sold to a man who exhibited it about the streets, calling it "a cross between a shark and a whale." Mr. Flower will publish its anatomy, and the specimen will be placed in the British Museum.

SCIENTIFIC DIARY.

WEDNESDAY, March 23rd.

Society of Arts, 8 p.m. "On State Railways for India," by W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways. "Tramways for Street," Discussion.
Royal Society of Literature, 8.30 p.m.
Geological Society, 8 p.m. "Discovery of Organic Remains, Caribean Series of Trinidad," by Mr. R. J. Lechmere Guppy. "Palæontology of Junction-Beds of Lower and Middle Lias, Gloucestershire," by Mr. Tate. "Geology of Waipara River District, New Zealand," by Mr. T. H. C. Wood.
Archæological Association, 8 p.m. "Holbein as an Historical Painter," by Mr. H. F. Holt.
Hunterian Society, 8 p.m. "Some Experiences of an American Tour," by Dr. Peacock.
Glasgow Philosophical Society, 8 p.m. "Notes upon the Appearance and Chemical Constitution of Ancient Glass found in Tombs in the Island of Cyprus," by Mr. John M. Thomson. "On the recent Progress of the Iron Manufacture in Cleveland," by Mr. John Mayer.

THURSDAY, 24th.

Royal Society, 8.30 p.m. "On the Madreporia dredged up by the Expedition in H.M.S. *Porcupine*, 1869," by Prof. Duncan, F.R.S.
Society of Antiquaries, 8.30 p.m. "Greek Inscription found at Autun by Cardinal Pitra," by the Rev. W. B. Marriott.
Zoological Society, 8.30 p.m. "On the Birds of Veragua," by Mr. Osbert Salvin. "Exhibition of a Metamorphosed Axolotl," by Mr. W. B. Tegetmeier. "On two rare species of Pheasants recently added to the Society's collection," by Mr. Sclater.
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.
Royal Society Club, 6 p.m.
London Institution, 7.30 p.m.
Newcastle Chemical Society, 7.30 p.m.

FRIDAY, 25th.

Quekett Microscopical Club, 8 p.m. "On Microscopic Moulds," by Mr. M. C. Cooke.
Royal Institution, 9 p.m. "On the Anglo-Saxon Conquest," by Prof. Rolleston.
East India Association, 8 p.m. "On the Additional £100,000,000 proposed to be Expended for Railways in India," by Lieut.-General Sir Arthur Cotton.
Clinical Society, 8.30 p.m. "Atrophy of Brain, with very low Temperature," by Dr. Greenhow. "Imperforate Anus," by Mr. C. Heath. "Keloid of Allbert," by Dr. Duckworth. "Fatal Epileptic Stupor," by Dr. Handfield Jones. "Artificial Respiration in apparent Death from Epileptoid Fits," by Dr. Leared for Dr. H. Jones.

SATURDAY, 26th.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. "On the Sun," by Mr. Lockyer.

MONDAY, 28th.

Royal Geographical Society, 8.30 p.m.
Society of British Architects, 8 p.m.
Institute of Actuaries, 7 p.m.
Medical Society of London, 8 p.m.
London Institution, 4 p.m.
Glasgow Philosophical Society, Chemical Section, 8 p.m. "On the Method for Obtaining a Continuous Current of Air or Gas under pressure for Blowing-pipe or other purposes," Mr. T. L. Paterson.

TUESDAY, 29th.

Institution of Civil Engineers, 8 p.m.

WEDNESDAY, 30th.

Society of Arts, 8 p.m. "On Submarine Channel Communication," by Thomas Page, Esq., C.E.
Glasgow Philosophical Society, Sanitary and Social Economy Section, 8 p.m. "On Defects in House Construction," by Mr. R. M. M'Intyre.

ELECTRO-THERAPEUTICS.—"A. R."—We could quite understand the results you describe, provided that the current used was that of the ordinary galvanic battery, or what is known as the constant current. We believe, as we know from experience, that the induced current, known as *Faradization* to medical men, intensifies pain very much. The researches of Remak abroad, and of Dr. C. B. Radcliffe in this country, have demonstrated that the continuous current when passed across the course of a nerve produces in the nerve a complete state of anæsthesia. We have seen various forms of neuralgia relieved by the application of the constant current, but we believe that the only successful method of dealing with these cases is by the hypodermic introduction of morphia with the sub-cutaneous syringe.

SIR W. THOMSON *v.* GEOLOGY.—"D. G. W."—Communication was duly received. "De gustibus," &c.

SOCIÉTÉ VAUDOISE DES SCIENCES NATURELLES.—"E. R."—Our best thanks for the letter. The proposal shall be laid before our publishers.

COPIES FOR CIRCULATION.—"W. K."—Letter received.

BOSTON SOCIETY OF NATURAL HISTORY. "R. B."—We are much obliged for the communication. The works were duly received.

LINNEAN SOCIETY.—"R. K."—Communication received. Why do you not send us notice of the papers to be read, and brief reports of the meetings?

ASTRONOMY AND ITS PROPHET.—"A. P."—Mr. John Hampden starts a wager between God's science and man's, and backs the former with £500!' If old Hosea Biglow could only get hold of this, it would extinguish "J. P. Robinson" altogether.

GEOLOGISTS' ASSOCIATION.—"J. M."—Copy received. Proof was forwarded to you.

BRITISH ASSOCIATION REPORT.—"H. H."—As the volume of Reports is now published, there would be no use in reproducing the paper. You have not mentioned the subject.

MACHINE-MADE JEWELLERY.—Mr. Streeter's interesting pamphlet has reached us. We shall have something to say of it in an early number.

ABYSSINIAN GOLD. The specimen sent is most curious and interesting. It defies detection from gold by ordinary tests, such as colour and weight. The workmanship too is good. It shall be noticed in our next.

THE WHITE HAND shall be noticed in our next.

EAST KENT NATURAL HISTORY SOCIETY.—"J. R."—Your letter reaches us just as we go to press. The parcel has not yet arrived. We shall hope to publish the reports regularly.

COAL FOSSILS.—"T. P. B."—Too late for this number. In our next.

NOTICES.

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WEDNESDAY, MARCH 30, 1870.

DEMONSTRATIONS *VERSUS* LECTURES.

THE fact that a number of artisans were last week shown over the British Museum by Professor Owen and Mr. Woodward is symptomatic of the great educational revolution through which we are now passing. It shows us that the principle of object-teaching is getting beyond the mere sphere of children's schools, and that an idea is now at last being recognized of the necessity for demonstration in the teaching of scientific subjects. The visit which Professor Morris and the members of the Geologists' Association paid to the Museum is a fact in the same direction. There cannot be the smallest doubt that, as Science is now taught in the greater number of even Scientific Institutions, the general result is "cram." The students yawn and gape, and try to keep awake while a lecturer is drowsily and drearily intoning a discourse which he delivers from manuscript, and save that now and then, when a diagram is referred to or a "stock" specimen is lifted up and replaced on the table, there is really nothing to convey to the student any realization of the subject. How is it to be expected that any good can come of such a system? The pupil very seldom handles and examines a third of the objects concerning whose history and characters he has to strain his memory, and in not one case in a thousand is he shown how to make researches on his own account. This latter is a point of real importance, and one which we know is much neglected in our schools of Science. There are, of course, now and then young men of wonderful energy who, striving against no end of difficulties, will try to make out for themselves whether the statements made in the lectures be really true or not. These afterwards become discoverers; but surely their teacher is hardly to be credited with the fact, for such men would assuredly have turned to original research by the force of their very natures. But how many are there even now attending scientific lectures who would also distinguish themselves as investigators where they only shown the way? We venture to say hundreds. And this is why we would wish to see less of lectures and more of demonstration in our Science schools. As it is, there is far too much of written discourses, black-boards, and diagrams.

A very distinguished examiner in one of our universities not long ago said to us, "I note the absence of demonstrative teaching, especially in our medical schools. Very few of the candidates for degrees know anything of really practical physiology. They can write volumes on the nature of vital force or the theory of reflex action, but if asked what will be the effect of an injury to the spinal cord at this or that point, I notice that they are often puzzled." In the truth of this statement we have the most implicit belief. Physiology is almost untaught in England. Microscopic Anatomy is nearly as little taught, save in one or two schools. That is, they are not dealt with as they should be. Experiments are not made in the one case, and the student is not shown the microscopic structures in the other. In hardly any instance does the student learn how to conduct practical inquiries on his own account.

The branches of Science in which demonstration is so much neglected are the natural and not the physical. Physics and Chemistry are taught in a thoroughly demonstrative manner in most of our schools, and in some there is an attempt made to teach the student methods of original research. But in Geology, Palæontology, Botany, Zoology, Physiology, and Histology, there is nothing like adequate demonstrational teaching in any of our schools. A few specimens are arranged on the table, and diagrams hang on the wall; there is a black-board and chalk, but in too many cases the lecture is delivered from paper.

We should like to be able to say in a few years *Nous avons changé tout cela.* Could not the Professorial method be entirely abolished, and a combination of the tutorial plan and the demonstrational be adopted? If this could be achieved, Science would make immense advances in this country; for not only would those who study it understand their subject and feel an interest in it impossible under the existing system, but, by a little additional exertion on the part of the teacher, a very large proportion of his class might be shown the way to conduct original investigations; and it is only by such work that the value of Science in education can be appreciated.

We know that there are some of our leading teachers in Science who already do all, or nearly all, that we have suggested, but they are the few, and we should like to see them the many.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

A SCIENTIFIC Commission of a most remarkable character has originated in Russia. A number of Russian *savants* are about to set out on a tour over Europe, and possibly America, with the object of studying the progress of the Sciences in all their various branches. This Commission will consist of the ordinary Professors of the University of Kiew—Professors Chronszcewsky, Kowalewsky, and Hibel; of the Grand Master of the University of Dorpat—M. Kepen; of Professors Prachoff and Baraniecky of the University of St. Petersburg; of M. Sobler, Professor in the University of Moscow; of Professors Wladiniwoff and Kolosoff, of the University of Charkoff; and lastly, of MM. Brandt and He, Professors of Surgery in St. Petersburg and Kasan. The further plans of the Commission have not yet been published.

MR. BIRT informs us that twelve months' observations of the spots on the floor of the lunar crater Plato are just completed. The number of observations amounts to 771, the number of spots on the floor being 35. The curves of visibility of 14 spots have been projected with a result strongly indicative of an *intermittent* action similar to that manifested by terrestrial volcanoes. Some of the spots selected have *not* been seen for four consecutive lunations, after which they have again become visible.

DR. M'NAB has been appointed Professor of Natural History in the Royal Agricultural College, Cirencester. We do not know whether we may congratulate Dr. M'Nab on his appointment to Cirencester, but we certainly congratulate the College on its obtaining so distinguished and hardworking a student of botany and vegetable histology.

WE stated some time since that there were fifty-three candidates for the fifteen fellowships of the Royal Society. We can now supply the names, no less than twenty-one of which are those of medical men:—William Baker, C.E.; E. M. Barry, R.A.; Rev. Francis Bashworth, B.D.; B. E. Brodhurst, F.R.C.S.; Samuel Brown, P.I.A.; James Brunlees, C.E.; F. T. Buckland, M.R.C.S.; G. W. Callender, F.R.C.S.; Commander William Chimmo, R.N.; F. Le G. Clark, F.R.C.S.; Henry Dircks; Alexander Fleming, M.D.; P. Le N. Foster, M.A.; Sir Charles Fox, C.E.; William Froude, M.A.; T. M. Goodeve, M.A.; E. H. Greenhow, M.D.; E. T. Higgins, M.R.C.S.; Rev. Thomas Hincks, B.A.; Charles Horne; Rev. A. Hume, LL.D.; James Jago, M.D.; W. S. Jevons, M.A.; George Johnson, M.D.; M. K. King, M.D.; J. A. Langridge,

C.E.; N. S. Maskelyne, M.A.; M. T. Masters, M.D.; Major F. G. Montgomerie, R.E.; Alfred Newton, M.A.; Andrew Noble; Thomas Nunneley, F.R.C.S.; E. L. Ormerod, M.D.; Captain Sherard Osborn, R.N.; Rev. Steven Parkinson, B.D.; Captain R. M. Parsons, R.E.; W. O. Priestley, M.D.; C. B. Radcliffe, M.D.; W. H. Ransom, M.D.; E. J. Reed, C.B.; W. J. Russell, Ph.D.; R. H. Scott; John Shortt, M.D.; Edward Thomas; C. F. Varley, C.E.; G. F. Verdon, C.B.; Augustus Voelcker, Ph.D.; Viscount Walden, P.Z.S; G. C. Wallich, M.D.; A. T. H. Waters, M.D.; Samuel Wilks, M.D.; Captain C. W. Wilson, R.E.; and John Wood, F.R.C.S.

The unpleasant quarrels and general state of insubordination lately reported as existing in Queen's College, Galway, appear to have undergone no abatement. The latest news we hear is that Mr. Ward, the demonstrator of anatomy, has resigned his post. In a letter which that gentleman has addressed to the President of Queen's College, Galway, he declares, *à propos* of the charges brought against some of the Professors conducting the Clinical Department of the Medical School, that these were such as no man connected with that school could safely contradict; and he concludes by saying that he has strong opinions on the way in which some medical Professors discharge the duties of medical education, and that it may be soon time for him to express them; but that, meanwhile, he feels it impossible to hold his office in the existing state of things. This really looks as though a searching public inquiry were necessary. We think that the College authorities, who can, no doubt, justify the somewhat severe course they have lately adopted, should be the first to court inquiry into the justice of the measures pursued by them. The present condition of *bouléversement* is one most detrimental to the interests of certainly as good a scientific school as there is in the kingdom.

At last there is some fair prospect of the establishment of a Royal Society of Medicine in London. The adjourned meeting of the Royal Medical and Chirurgical Society was held on the 14th inst., to consider the resolutions proposed by the committee of delegates to promote an amalgamation of various Medical Societies. The proceedings were altogether of a formal character, only a few verbal alterations being made in some of the resolutions which in no way altered their sense; and they all were adopted with nearly complete unaniminity. The only important modification, therefore, which has been made in the scheme sent up by the committee of delegates, consists in the reunion of Medicine and Surgery in a Medico-Chirurgical Section, and the formation of a Physiological and Anatomical Section; so that the sections proposed to be formed are precisely the same as originally agreed upon by the Society at its meeting in May last. We have heard nothing, however, of the establishment of a Therapeutical Section, and we must confess that in the opinion of very many of the younger members of the profession such a section is much required.

It may interest those of our readers who sided with us in the view we took concerning the proposed abolition of the chair of the late Professor Penny to know that a brief but feeling memoir of the Professor has just been written by Dr. James Adams. The pamphlet is printed for private circulation.

The Society of Arts has undertaken a task which cannot but be attended with the very best results, and for which it merits the highest praise. It has published, as a supplement to its *Journal*, a statistical account, accompanied by a map or plan of the educational—or rather non-educational—character of one square mile of the East-end of London. In this we find stated the population, the number of schools receiving Government grants; the number of schools receiving Government inspection but no grants; the number of schools not inspected; the number of schools proposed to be enlarged; and, lastly, the number of new schools proposed. In this square mile there are 165 public-houses and 166 beer-houses, and the estimated amount annually spent in them by these very poor people is not less than £450,000. If one penny out of every eight now spent in drink were put by for one year, the amount raised would more than build the schools required, and one penny out of every twenty-eight would keep them up efficiently, without any Government aid or assistance from charity.

Those who occasionally travel to Dublin or Edinburgh by the night mails know how pleasant it is to procure a pair of cross-sticks from the guard, and covering them with cushions, thus to make a sort of couch on which even disturbed rest can be had for an hour at a time. Such travellers will be delighted to hear of a new proposal which the *Builder* describes:—Mr. Howlison, of Glasgow, proposes to make use of the existing compartments of railway-carriages, his arrangement permitting them to be used either for sitting or sleeping, at the will of the passengers. Unless when used for sleeping, the compartments will present almost exactly their present appearance, and the sleeping arrangement will consist, in first-class carriages of one shelf, in second-class carriages of two shelves, placed at equal distances above the present seats, of equal breadth with them, and extending in the same direction. The arrangement is, in short, similar to that of berths in ships; and the railway berths may be made equally, if not more, commodious. Under this system a first-class compartment could hold only four, and a second-class six, passengers.

Attempts are being made in France to cultivate the Chinese primrose in the open air. It is known, says the *Gardeners' Chronicle*, that the plants grow freely in China and Corea, in colder latitudes than those of France, the sloping sides of the valleys being in many cases covered with them. An amateur gardener, in order to try the robustness of this primrose, left a root out against the foot of a north wall, during the whole of the month of January last, which was not at all warm, and it was not destroyed. This, of course, does not prove *much*, but it just holds out a hope of the possibility of acclimatizing this very charming and early flower; and if horticulturists succeed in growing it out of doors in the north or centre of France, those of the south of England may do the same.

Mr. Foley, the sculptor, has received the commission for the Faraday memorial. The work, when finished, will be placed in the British Museum, where, in the hall, a fitting sepulchre (!) will be found for it. Truly, "He that humbleth himself is exalted,"—at least, in England.

The *British Medical Journal* tells us that M. Félix Roubaud has just started a new medical journal. It is "*cautionné et timbré*"; so that it is evidently intended as an organ of medico-political opinions, as well as of medical science. The ordinary medical journals do not pay caution-money or stamp-duty, and are consequently legally disqualified from treating political questions. The name of the new journal is *L'Opinion Médicale.*

Dr. Sanderson and Mr. Hulke have resigned their joint lectureship on Physiology at the Middlesex Hospital Medical College. This is a serious blow to the prospect of a medical school which was, of late years, commencing to be prosperous. The loss of two such genuine labourers in the field of science as Mr. Hulke and Dr. Burdon-Sanderson cannot easily be repaired.

It is stated on authority that Mr. W. Egerton Hubbard's prizes, offered through the medium of the Royal Horticultural Society, have been awarded as follows:—For an Essay on Cottage Gardening, the prize of £5 to Mr. E. W. Badger, *Midland Counties Herald*, Birmingham; for an Essay on Window Gardening, the prize of £3 to Mr. H. Buttery, Clapham. For the former prize thirty-four essays were sent in, of which number those from Mr. W. P. Ayres, Nottingham, and Mr. E. Luckhurst, Egerton House Gardens, Kent, were highly commended; and those from Mr. D. T. Fish, Hardwicke House,

Bury St. Edmund's; Mr. A. Meikle, Read Hall, Whalley; Mr. P. Grieve, Culford; and Mr. W. Earley, Digswell, were severally commended. For the window gardening prize eighteen essays were contributed, that from Mr. D. T. Fish being highly commended, and those from Mr. E. Luckhurst, Egerton House Gardens; Mr. A. Meikle, Read Hall; and Mr. W. Moss, Shelfield, Wickham, Hants, were commended.

The fourth grand State fair of the Mechanics and Agricultural Fair Association of Louisiana will be held at New Orleans in April of this year, commencing Saturday, the 23rd, and continuing nine days. The fair will be held on the extensive grounds of the association in the above city, and a greatly enlarged list of premiums is offered. Visitors and exhibitors are invited from every section of America. It is announced that railroads, steamships, and other transportation lines will carry exhibitors and their wares at half price. The secretary of the association is Mr. Luther Homes, who may be addressed by those who wish for further information.

The season of the Royal Botanic Society commences to-day with an exhibition of spring flowers.

A new discovery of coal in the Brazil is just announced. R. von Brause states that he has discovered coal of very good quality in the Santa Cartharina, near Ararangua. The seam which crops out has been explored for a distance of some thirty miles, and found to be of an average thickness of one mètre. This coal has been thoroughly tested and analyzed by Dr. Netto, of Rio de Janeiro, and is interesting as one of the very few instances of a true coal occurring in a recent geological formation, although in the United States and in Hanover (on the very borders of the Netherlands) two or three such occurrences are on record. The coal here alluded to is an excellent quality of gas-coal.

The Isthmus of Corinth is at last to be cut through; it is to be "Lessepsed," but not by Lesseps. The undertaking is conceded, by a decree of February 9th, ult., to Mr. Maxime Chollet. The works are to be commenced within eighteen months, and to be completed within six years; the depth to be 7·80 mètres = 25⅝ ft. Rates, as for the Suez Canal, to be levied on ships only, goods being free. The Government grants to the concessionnaires all the land necessary for the canal, and 5,000 hectares = 12,350 acres, on each side; also the privilege of working the mines, quarries, and forests of the State situate within a distance of 30 kilomètres = 19 miles, on either side of the canal.

The Royal Dublin Society has commenced its session for the delivery of popular scientific lectures. Some of last year's courses, reproduced in Scientific Opinion, were of the deepest interest. Mr. Huggins has already given one of the present course of lectures "On Recent Solar and Stellar Discoveries." Amongst others it is announced that Dr. R. M'Donnell will give a lecture "On Phosphorescence and Fluorescence;" Professor Hull, "On the Coal-fields of Great Britain;" Dr. Wyville Thomson, "On the Deep-sea Soundings during the Cruise of the *Porcupine*;" Dr. Humphrey Minchin, "On some interesting Phenomena of Sound;" and Dr. J. Emerson Reynolds, "On Ozone, its Nature, Properties, and Uses."

On Friday evening next, Dr. Hyde Clarke will open a Conference at the Society of Arts "On the Through Route to India." The chair will be taken at 8 o'clock. Members and their friends are invited to attend.

We believe that the Horticultural Society has made arrangements by which it will retain a portion of the old Chiswick Garden. It is said that the terms of the arrangement are very satisfactory.

The Medical Scientific School at King's College is about to undergo serious changes. Sir William Fergusson resigns his chair of Systematic Surgery, and Mr. Partridge his appointment as surgeon to the hospital. Sir William will, however, be appointed Professor of Clinical Surgery; while Mr. Partridge still retains the chair of Anatomy. Mr. Wood is expected to succeed Sir William Fergusson as Professor of Systematic Surgery.

The first of the series of Annual International Exhibitions of selected works of Fine and Industrial Art and Scientific Inventions will be opened at South Kensington, London, on Monday, the 1st of May, 1871, and closed on Saturday, the 30th September, 1871.

The result of some recent American microscopical examinations does not favour Dr. Tyndall's views. The dust obtained from the places of amusement in New York has been analyzed by the scientific officers of the Metropolitan Board of Health. Over one hundred specimens of the particles floating in the air and falling as dust, were collected on plates of glass, and were examined under the microscope. The proportions of the different ingredients varied, but the same substances were found in all the specimens. The composition of the matter subjected to the microscope was as follows:—"The dust of the streets in its finer or coarser particles, according to the height at which it had been collected, with a large proportion of organic elements; particles of sand, of quartz and feldspar; of carbon, from coal-dust and lampblack; fibres of wool and cotton of various tints; epidermic scales; granules of starch, of wheat, mainly the tissues of plants; the epidermic tissue, recognized by the stomata or breathing pores; vegetable ducts and fibres, with spiral markings; vegetable hairs or down, either single or in tufts of four or eight, and of great variety, and three distinct kinds of pollens. Fungi were abundant, from mere micrococcus granules to filaments of mould. When water was added to a portion of dust from whatever source, and exposed in a test-tube to sunlight or heat for a few hours, vibriones and bacteria made their appearance.

We understand that a new edition of a work, entitled *The Honeybee: its Natural History, Physiology, and Management*, by Ed. Bevan, M.D., revised and enlarged, with copious illustrations, by Wm. Augustus Munn, F.R.H.S., &c., is in the press, and shortly will appear.

Dr. Roth has issued a pamphlet, addressed apparently to the Government, in which he urges the claims of physical education to rank with reading, writing, and arithmetic in schools. We do not, however, exactly comprehend what Dr. Roth means to include under physical education. Clearly it is not physics. We fancy he means hygiene; but we are in doubt whether the movement-cure or athletics is not also intended.

The French Academy of Medicine has been doing honour to the press. At its meeting on the 15th it elected M. Amédée Latour, many years editor of *L'Union Médicale*, to the honorary rank of Associate. This may fairly be regarded as a compliment paid to the medical press of Paris in the person of one of its most worthy representatives.

The *Athenæum* states that M. André Leroy, of Antwerp, is engaged on a Dictionary of Pomology; three large volumes are ready, and treat of pears, apples, quinces, service-trees, and medlars. Two more volumes will complete the work, one of which will treat of stone-fruits, the other of grapes and miscellaneous fruits. Each species of fruit is treated in an elaborate way, and to the mode of its culture is prefixed a history of its culture (besides several types of each variety—915 varieties of pears are described), and each description is accompanied by a woodcut.

On Saturday the members of Working Men's Clubs visited the British Museum, under the guidance of Professor Owen and Mr. Henry Woodward. Professor Owen explained the nature of the extinct animals. The next visit will be made to the National Gallery, under the guidance of Mr. Francis Turner Palgrave.

M. T. C. Breiaut, reporter in Class 86 of the Paris Exhibition, desires the introduction of maize into England as a green vegetable. His observations certainly have considerable force. He writes as follows:—"Two seasons of experience in the attempt to grow varieties of maize which would take a good place as table vegetables in this country have proved so successful as to make me wish to spread more fully the knowledge. Maize, though the staple food of millions, in a green state, is not known in England as it deserves to be. This arises because the only variety common is the yellow maize of commerce, which is too coarse in flavour to be used fresh. Some time ago I introduced twenty new varieties, never previously to the late French Exhibition grown together, and now, after two very dissimilar seasons, it is fairly shown that they are well adapted to continue the season in the autumnal months, reproducing the flavours of the pea and asparagus. Of the value of maize as a nutritious vegetable of great value for invalids and others there was never any question. Its culture hitherto has been omitted because the pure white varieties from Georgia were not known; and, but for the Exhibition of 1867, would scarcely have been appreciated. Among the others are very beautiful red, blue, and pink hybrids, and their grand appearance is, of itself, no little recommendation."

Yet another new journal. To-day is published the first number of a monthly periodical devoted to the literature of the fragrant weed. It is really an interesting paper, and bears the name of *Cope's Tobacco Plant*. Its leader asks the important question, "Why cannot Great Britain grow tobacco?" To which we can give a satisfactory answer in five words—Mr. Lowe won't allow it.

CONGELATION OF PERSONS KILLED BY LIGHTNING.

BY M. LE PROFESSEUR A. POËY.

General Comte de Maistre, son of the illustrious author of *Soirées de Saint-Pétersbourg*, informs Dr. Boudin that some Sardinian sailors killed by lightning in the Mediterranean presented all the signs of death by *freezing*. "This observation is the more remarkable," adds M. Boudin, "as it recalls the congelation of wine long ago noticed by the ancients."[1] On a man struck by lightning toward the back of the head, at the passage of the stroke, there could be found neither fracture, nor fissure, nor yet an alteration in any other part of the skull. The brain was also very sound, there being alone at the superior part *congealed lymph*, which had infiltrated into the folds of the *pia mater*. This young man, killed by the stroke, remained *immobile*.[2]

If the congelation of persons killed by lightning has been well observed, if it has not slipped in by some illusion in the observer's mind, and if especially this fact comes to be confirmed, here is the explanation of it which I would propose: The recent researches of MM. Joule, Clausius, Thomson, and others, have led physicists to regard heat as resulting from a rotatory motion of the particles about an axis, and M. de la Rive has considered this hypothesis as calculated to explain the polarity of atoms. This *savant* then asks, "If it might not be possible that the cause of the heat generated by the reunion of the two electricities, brought about under the form of discharge or current, may be not in the fact itself of this reunion, but in an increase of molecular motion, which might result from the transmission of electricity?"[3] Consequently, according to this theory, a current or an electrical discharge directed upon a body, must give rise to two molecular motions in contrary directions, and in the sequel to effects equally inverse. In the first case, the current being directed *in the same way* as the polarity which produces the natural heat of the body, it is evident that it augments the rotary motion of the particles around their axes, raises their temperature, and produces in proportion to its energy new thermo-mechanical effects. The result, therefore, will be the elevation of the temperature of the body traversed by the current or electrical discharge. In the second case, the current being, on the contrary, *in an inverse direction* from the polarity which produces the natural heat of the body, it is also evident that it diminishes the rotary motion of the particles around their axes, lowers the temperature, and produces, as in the first case, thermo-mechanical effects proportional to its power. The result will therefore be a lowering, instead of an elevation of the temperature, which lowering may descend to the freezing-point.

It is according to this principle that M. de la Rive explains the thermo-electrical properties of some metals of crystalline molecular structure, in which is sometimes observed, as Pettier first proved, a lowering of temperature by the reunion of the two electricities, as far as the freezing-point of water, and even according to the experiments of Lenz, in five minutes this lowering of temperature reached 4° C. (24° Fahr.).[4]

Seeing that modern physics can supply us with an explanation so satisfactory, we can now readily understand that the congelation of persons or liquids struck by lightning should not be to us a surprising phenomenon. In fact, one has but to suppose that the discharge of the lightning takes place in an *inverse direction* to the polar rotation which the molecules of the body possess for the purpose of originating its own heat; and that then this rotation or motion of heat, having been reversed and diminished, the lowness of the temperature produced may reach congelation. Indeed, heat, properly so called, depends upon a molecular vibration, more intense and in a certain direction; minimum heat, or *cold*, depends also upon this same vibration, but less intense and in an opposite direction.—*New York Medical Journal*, March.

[1] Boudin. Mêmes *Annales*, and p. 43 du tirage à part.

[2] *Histoire de l'Académie des Sciences de Paris*, 1863, t. ii. p. 111.

[3] De la Rive (August). *Traité de l'Electricité théorique et appliquée*, t. ii. p. 247. Walker's trans., vol. ii. p. 308.

WHAT IS BRICK TEA?

BY WILLIAM COCHRAN, M.R.A.S.

The utilization of the refuse of the tea manufacture is a feature in Chinese economy which well deserves the attention of our Indian planters; and the admirable product resulting from it claims the attention of philanthropists both there and at home. It is well-known that, from the prolonged manipulation which tea leaves undergo, a large percentage becomes much broken, or is reduced to powder, and thereby deteriorated in value. It may seem strange to many why tea dust and siftings should be considered as refuse at all, seeing they are still tea; more especially when, as a rule, they yield a stronger infusion than the finest and most perfectly curled leaves. This apparent incongruity disappears, however, on closer investigation. When in the form of dust its liability to adulteration with sand or other heavy foreign substance is vastly increased; and, as siftings, fannings, or broken leaf, an irresistible temptation is offered to the introduction of the broken leaves of other less valuable plants. Then again the darker infusion is usually obtained only at the first maceration, the boiling water so acting on the pulverised leaves that nearly their whole strength is extracted at once; whereas, with closely twisted leaves, a second, third, or sometimes even a fourth infusion fails to deprive them of all soluble material. Under such circumstances the Chinese merchant, in order to encourage business in good leaf, frequently sells his dust and siftings at a low figure, if not at a price under cost. But it

[4] De la Rive (August). Work cited, t. ii. p. 242; Walker's translation, vol. ii. p. 305.

happens that a vast quantity of refuse is produced in a district of the Empire so remote from the "Treaty ports," where alone business can be profitably transacted with foreigners, that some other opening had to be discovered. Such an outlet the Chinese speedily found in the manufacture of brick tea for the Russian market.

This strange phase of the fragrant herb takes three forms: Large Green, Small Green, and Black Bricks.

The large green variety is manufactured in the hilly regions in the province of Hupeh, about two hundred miles west of Hankow. It is fabricated out of the coarser leaves and upper twigs of the *Thea viridis*, to which are added much of the broken leaf and dust resulting from green tea manipulation. The mass is simply moistened by the application of steam, then compressed in wooden moulds, having the chop of the manufacturer cut in relief on one of the inner surfaces. The bricks are then piled up in stacks protected from the sun and rain, but having a free current of air circulating through and around them. When quite dry, each brick is enveloped in paper; thirty-six bricks, built into an oblong figure, are covered with dry fragrant leaves, and the whole matted over. Such packages are known as "baskets."

In colour this form of tea exhibits a dusky green, and is now made to a large extent by the Russian agents of the Kiachta merchants. It sells at Kiachta at about three roubles (1 rouble = 3s. 2d. sterling) more per basket than that made by the Chinese; but then it should be remembered it costs the Russian agents from 50 to 75 tael cents (1 tael = 6s. 8d. sterling there) more at Hankow. Large green bricks measure $13 \times 6\frac{1}{2} \times 1\frac{1}{4}$ inches, the weight of the basket being about 83 catties, or nearly 111 lb. avoirdupois.

Unlike the method employed in Mincing-lane for testing the quality of tea, the Mongol buyer proves the soundness of his purchase by placing a brick upon his head and pulling the extremities downwards with both hands; should it neither yield nor break it is considered sound; if it bends or fractures it is unhesitatingly tossed aside as worthless. Occasionally, a similar test is practised over the bended knee.

Among all the native inhabitants of Mongolia, and a large number of the Bouriats who live in the neighbourhood of the Russo-Mongolian frontier, this description of tea is in favour. The chief markets are Chang-kia-kow, Ourga, and Kiachta.

Small green brick tea is always superior to large, from the simple circumstance that much greater care is bestowed on the selection of the materials, and during the manufacture; consequently it commands a higher price, although its fabrication is similarly conducted. It is consumed by the Siberian peasantry and the better class of Bouriats and Toungous resident near the Mongolian frontier. Even the Mongol mandarins, both in their native country and when attached to the court at Pekin, prefer this tea. The usual size of the bricks is $8\frac{1}{2} \times 5\frac{1}{4} \times \frac{1}{5}$ in., and the principal emporiums for their distribution are Kiachta, Chita, and Nerchinsk.

Neither of these two forms of brick tea undergo fermentation. Black brick tea, named in Mongolia "Dirintirroo," is made into cubes of the same size as small green. It consists of siftings, fannings, and the dust resulting from the preparation of Moning and Kaisow teas for the London market, with an admixture of Bohea and small twigs. Like small green, it is usually packed with 64 or 72 bricks in a basket, and is in request among the Tartars or Khirgis of Western Siberia. Large quantities are also sold to the peasantry residing on the western shores of Lake Baikal. The native markets are Kiachta, Irkoutsk, Omsk, Tomsk, Kazaw; and Nijni Novgorod and Irbit, during the fairs.

The average prices obtained by the Russians at the markets stated are as follows:—

Sort.	Basket of	Per Basket.	Weight.
Large green bricks...	36 bricks.....	4 taels	111 lb. avoird.
Small green ,, ...	64 ,, ...	4 ,, ...	93¼ ,,
Small black ,, ...	64 ,, ...	4½ to 5	93¼ ,,

As already mentioned, the brick tea of Chinese manufacture fetches a rather lower price.

A few statistics may prove instructive, especially to such of our Indian tea-planters as, from the favourable position of their gardens, may in future have opportunities of cultivating the brick tea-trade in competition with the Russian merchants.

The commerce, until within the last nine years, was wholly in the hands of the Chinese; but, forecasting events, and depending on the superiority of European to Asiatic manipulation, the Russian merchants of Kiachta boldly sent their own agents to Hupeh, who have not only succeeded in producing a better quality of tea, but have since then monopolized a considerable percentage of the brick tea trade. This no doubt arose partly from the fact that foreigners possess an advantage over the Chinese, inasmuch as they are not mulcted in such heavy inland duties. To show the extraordinary progress made by the Russians, it may be mentioned that in 1865, only two years after they commenced the manufacture their agents forwarded to Kiachta 15,000 baskets, whilst the Chinese during the period received only 30,000 at their old established emporium at Maimaichin, 150 yards from Kiachta; in short, the quantity of Russian manufactured brick tea which crosses the frontier is annually increasing, whereas that made by the natives is as steadily on the wane.

The sales at Ourga, the capital of Mongolia, about 200 miles from Kiachta, are said to be upwards of 50,000 baskets per annum (over 5,000,000 lb., or more than half the entire produce of our Indian tea-gardens), of which nine-tenths are large green brick.

The Chinese transport the greater portion of their brick tea overland, *viâ* Shansi, whilst the Russians invariably send theirs *viâ* Shanghai and Tientsin to Kiachta, whence it is transported to Siberia, Tartary, and Russia, on the backs of camels.

In Mongolia and Tartary the method of preparing brick tea for drinking is unique, and is suggestive of a cheap and admirable substitute for food during times of commercial distress and famine, which we heartily recommend to the guardians of the poor at home, and to the Government of India.

It is rubbed to fine powder, boiled with alkaline steppe-water, to which salt and fat have been added, the decoction being carefully decanted. Of this liquid the nomadic races drink from twenty to forty cups per day, mixing it first with milk, butter, and a little roasted meal. But even with meal, they subsist on the beverage, and maintain perfect health and a robust physique for many weeks in succession.

It is not illogical to argue, from the foregoing, that the use of brick tea, prepared in a similar manner, and introduced into our various unions, casual wards, and prisons, in a country less exposed to climatic severity than the steppes of Tartary or the wintry solitudes of Siberia, would be productive of economy, not to mention the deterrent influence that such unusual fare could not fail to exercise on the class of people habitually finding their way to these refuges.—*The Food Journal.*

ON THE TEMPERATURE AND ANIMAL LIFE OF THE DEEP SEA.

BY WILLIAM B. CARPENTER, M.D., F.R.S.

IN FOUR PARTS.—PART II.

IN order to connect the work of the *Porcupine* with that of the *Lightning* expedition, it will be desirable to commence with the *third* cruise of the former, in which a detailed survey was made of the area traversed in the preceding year by the latter. In this cruise *bottom*-soundings were taken at thirty-six different stations, at depths varying from 100 to 767 fathoms; of these, seventeen were in the cold area and fourteen in the warm, whilst five exhibited

intermediate temperatures, in accordance with their border position between the two. In order to ascertain whether the *minimum* temperatures thus obtained were really the temperatures of the bottom, *serial* soundings were taken at three stations, of which one was in the warm area and two in the cold—the temperature at different depths between the surface and the bottom being ascertained by successive observations, at the same points, at intervals of 50 or 100 fathoms. All these results agreed extremely well with each other; and they closely accorded with the fifteen observations made in the *Lightning* expedition, when the requisite correction for pressure (from 2° to 3°, according to the depth) was applied to the latter (Table I.).

TABLE I.

TEMPERATURE OF THE SEA AT DIFFERENT DEPTHS IN THE CHANNEL BETWEEN THE NORTH OF SCOTLAND, THE SHETLAND ISLES, AND THE FAROE ISLANDS, as ascertained by *Serial* and by *Bottom* Soundings. (N.B.—The Roman Numerals indicate the *Lightning* Temperature-Soundings, corrected for pressure.)

Warm Area.						Cold Area.							
Series 87.						Series 64.		Series 52.					
Depth.	Temperature.	Station No.	Depth.	Surface Temperature.	Bottom Temperature.	Depth.	Temperature.	Temperature.	Station No.	Depth.	Surface Temperature.	Bottom Temperature.
fms.	°		fms.	°	°	fms.	°	°		fms.	°	°
0	52·6					0	49·7	52·1				
50	49·1	73	84	52·7	49·8	50	45·5	49·5	70	66	53·4	45·2
		80	92	53·2	49·4				69	67	53·5	43·8
100	47·3					100	45·0	47·3	68	75	52·5	44·0
		71	103	53·0	48·6				61	114	50·4	45·0
		81	142	53·3	49·1				62	125	49·6	44·6
150	47·0	84	155	51·3	49·2	150	43·3	46·5	60	167	49·5	44·3
		85	190	53·9	49·7				IX.	170	52·0	41·0
200	45·8					200	39·6	45·6				
		74	203	52·5	47·7							
						250	34·3	38·4				
300	46·6					300	32·4	30·8				
									63	317	49·0	30·3
									65	345	52·0	29·9
									76	344	50·3	29·7
		50	355	52·6	48·2	350	31·4	...	54	363	52·5	31·4
		46	374	53·9	46·0	384	...	30·6				
400	46·1					400	31·0	...	86	445	53·6	30·1
		89	445	53·1	45·6	450	30·6					
		90	458	53·1	45·2				56	480	52·6	30·7
		49	475	53·6	45·4				53	490	52·1	30·0
500	45·1					500	30·1	...	X.	500	51·0	30·8
		VI.	530	52·5	44·8				58	540	51·5	30·8
		47	542	54·0	43·8				VIII.	550	53·0	29·8
		XV.	570	52·0	43·5	550	30·1	...	77	560	50·9	29·8
									59	590	52·7	29·7
600	43·0					600	29·9	...				
		XVII.	620	52·0	43·5				55	605	52·6	29·8
		XIV.	650	53·0	42·5				57	632	52·0	30·5
						640	29·6					
700												
		88	705	53·5	42·7							
767	41·4											

The following general summary of these results brings into marked contrast the conditions of the warm and cold areas, which occupy respectively the W.S.W. and E.N.E. portions of the channel between the north of Scotland and the Faroe Islands, and lie side by side in its midst.

The *surface*-temperature may be said to be everywhere nearly the same, viz., 52°; the variations above or below this being attributable either to atmospheric differences (as wind, sunshine, &c.) or to differences of latitude. Alike in the warm and cold areas, there was a fall of from 3° to 4° in the first 50 fathoms, bringing down the temperature at that depth to 48°. A slow descent took place nearly at the same rate in both areas through the next 150 fathoms; the temperature in the warm area at the depth of 200 fathoms being 47°, whilst in the cold it was 45·7°. It is below this depth that the marked difference shows itself. For whilst in the warm area there is a slow and pretty uniform descent in the next 400 fathoms, amounting to less than *four degrees* in the whole, there is in the cold area a descent of *fifteen degrees* in the next 100 fathoms, bringing down the temperature at 300 fathoms to 30·8°. Even this is not the lowest; for the serial soundings taken at depths intermediate between 300 and 640 fathoms (the latter being the greatest depth met with in the cold area, midway between the Faroe and the Shetland Islands) showed a further progressive descent; the lowest bottom-temperature met with being 29·6°. Thus, while the temperature of the superficial stratum of the water occupying the cold area clearly indicates its derivation from the same source as the general body of water occupying the warm area, the temperature of the deeper stratum, which may have a thickness of more than *two thousand* feet, ranges from the freezing-point of fresh water to 2½° below it. Between the two is a *stratum of intermixture* of about 100 fathoms thickness, which marks the transition between the warm superficial layer and the body of frigid water which occupies the deeper part of the channel.

The shortest distance within which these two contrasted submarine climates were observed at corresponding depths was about 20 miles; but a much smaller distance was sufficient to produce it when the depth rapidly changed. Thus, near the southern border of the deep channel, at a depth of 190 fathoms, the bottom temperature was 48·7°; while *only six miles* off, where the depth had increased to 445 fathoms, the bottom-temperature was 30·1°. In the first case, the bottom evidently lay in the warm superficial stratum; whilst in the second it was overflowed by the deeper frigid stream.

It seems impossible to account for these phenomena on any other hypothesis than that of the *direct derivation of this frigid water from the Arctic basin*. And this agrees very well with other facts observed in the course of the exploration. Thus:—1. The rapid descent of temperature marking the "stratum of intermixture" began about 50 fathoms nearer the surface in the most northerly portion of the cold area examined than it did in the most southerly, as might be expected from the nearer proximity of the cold stream to its source. 2. The sand covering the bottom contains particles of volcanic minerals, probably brought down from Jan Mayen or Spitzbergen. 3. The fauna of the cold area has a decidedly Boreal type; many of the animals which abound in it having been hitherto found only on the shores of Greenland, Iceland, or Spitzbergen.

Although the temperatures obtained in the warm area do not afford the same striking evidence of the derivation of its whole body of water from a southern source, yet a careful examination of its condition seems fully to justify such an inference. For the water at 400 fathoms in lat. 59½° was only 2·4° colder than water at the same depth at the northern border of the Bay of Biscay, in a latitude more than 10° to the south, where the surface temperature was 62·7°; and the approximation of the two temperatures is yet nearer at still greater depths, the bottom-temperature at 767 fathoms at the former station being 41·4°, whilst the temperature at 750 fathoms at the latter point was 42·5°. Now, as it may be certainly affirmed that the lowest temperature observed in the warm area is considerably above the isotherm of its latitude, and that this elevation could not be maintained against the cooling influence of the Arctic stream but for a continual supply of heat from a warmer region, the inference seems inevitable that the bulk of the water in the warm area must have come thither from the south-west. The influence of the Gulf Stream proper (meaning by this the body of superheated water which issues through the "Narrows" from the Gulf of Mexico), if it reaches this locality at all—which is very doubtful—could only affect the *most superficial* stratum; and the same may be said of the surface-drift caused by the prevalence of south-westerly winds, to which some have attributed the phenomena usually accounted for by the extension of the Gulf Stream to these regions. And the presence of the body of water which lies between 100 and 600 fathoms' depth, and the range of whose temperature is from 48° to 42°, can scarcely be accounted for on any other hypothesis than that of

a *great general movement of equatorial water towards the Polar area*, of which movement the Gulf Stream constitutes a peculiar case modified by local conditions. In like manner the Arctic Stream which underlies the warm superficial stratum in our cold area, constitutes a peculiar case, modified by the local conditions to be presently explained, of *a great general movement of Polar water towards the equatorial area*, which depresses the temperature of the deepest parts of the great oceanic basins nearly to the freezing-point.

TABLE II.

TEMPERATURE OF THE SEA AT DIFFERENT DEPTHS NEAR THE WESTERN MARGIN OF THE NORTH ATLANTIC BASIN, as ascertained by *Serial* and by *Bottom* Soundings.

SERIAL SOUNDINGS.								BOTTOM SOUNDINGS.			
Depth.	Temperature. Series 23.	Temperature. Series 42.	Temperature. Series 22.	Temperature. Series 19.	Temperature. Series 20.	Temperature. Series 21.	Temperature. Series 38.	Station No.	Depth.	Surface Temperature.	Bottom Temperature.
fms.	°	°	°	°	°	°	°		fms.	°	°
0	57·3	62 6	56·9	54·8	55·5	56·2	64·0				
50	...	53·2						37	54	55·6	48·3
								34	75	66 0	49·7
								6	90	54·0	50·0
100	48·5	51·1						35	96	63·4	51·3
								8	106	54·2	51·2
								24	109	57·7	46·5
150	...	50·9						7	159	53·2	50·4
								14	173	53·2	49·6
								18	183	53·2	49·4
200	48·0	50·5						13	208	53·6	49·6
250	...	50·2	48·5	48·0	48·5	48 3	50·5	4	251	53·5	49·5
300	47·8	49·6									
350	...	49·1						1	370	54·0	49·0
400	47·5	48·5									
450	...	47·6						15	422	52·2	47·0
								45	458	60·7	48·1
500	45·8	47·4	46·7	46·7	46·9	47·5	47·8				
								40	517	63·4	47·7
550	...	46·4									
600	44·5	45·5						41	594	63·4	46·5
630	43·4										
650	...	44·3									
700	...	43·6						12	670	52·2	42·6
								3	723	54·5	43·0
								36	725	63·9	43·9
750	...	42·5	42·0	41·2	41·6	42·4	41·3				
800	...	42 0									
								2	808	54·1	41·4
862	...	39 7						16	816	53·0	39·5
900								44	865	61·2	39·4
1000	...	...	38·8	38·5	38·8	38·5	38·3				
1200								43	1207	61·7	37·7
1263	...	...	37·3								
								28	1215	57·7	37·1
1250	...	...	...	...	37·7	37·9	37·7	17	1230	53·2	37·8
1300								29	1264	56·9	36·9
1350	...	...	...	37·4							
1400											
1442	...	...	...	...	37·0			32	1320	55 9	37·4
1450								30	1380	56·0	37·1
1476	...	...	...	...	...	36·9					
1500	...	...	...	...	...	...	37·2				
1750	...	...	...	...	...	...	36·7				
2090	...	...	...	...	...	...	36·3	37	2435	65·6	36·5

During the *first* and *second* cruises of the *Porcupine*, the temperature of the eastern border of the great North Atlantic basin was examined at various depths between from 54 to 2,435 fathoms, and in widely different localities, ranging from lat. 47° to lat. 55°. The *bottom*-temperature was ascertained at thirty stations, and *serial* soundings were taken at seven stations; making the total number of observations eighty-four (Table II.). Amongst all these the coincidence of temperatures at corresponding depths is extraordinarily close; the chief differences showing themselves in the temperature of the *surface* and of the stratum immediately beneath it. A decided *super-heating* is observable in this superficial stratum, not extending to a depth of much more than 70 or 80 fathoms, and more considerable at the southern than at the northern stations. Whether this "super-heating" is entirely due to the direct influence of solar heat, or depends in any degree on an extension of the Gulf Stream as far as the southern part of the area examined, is a question which can only be resolved by the determination of its relative amount at different seasons. Between 100 and 500 fathoms, the rate of decrement is very slow, averaging only about 3° in the whole, or three-fourths of a degree for every 100 fathoms; and this body of water has a temperature so much above the isotherm of the northern stations at which the observations were made, as decidedly to indicate that it must have found its way thither from a southern source. Between 500 and 750 fathoms, however, the rate of decrease becomes much more rapid, the reduction being 5·4°, or above 2° per 100 fathoms; while between 750 and 1,000 fathoms it amounts to 3·1°, bringing down the temperature at the latter depth to an average of 38·6°. Beneath this there is still a slow progressive reduction with increase of depth, the temperature falling a little more than 2° between 1,000 and 2,435 fathoms; so that at the last-named depth, the greatest at which it was ascertained, it was 36·5°. Thus it is obvious either that the vast body of water occupying the deeper half of the Atlantic basin has been itself derived from a colder region, or that its temperature has been reduced by the diffusion through it of frigid water from a Polar source. The latter supposition best accords with the *gradual* depression of temperature exhibited between 500 and 1,000 fathoms, which corresponds with the "stratum of intermixture" of the cold area.

The temperature soundings recently taken by Commander Chimmo, R.N., and Lieutenant Johnson, R.N., at various points in the North Atlantic basin, when the requisite corrections are applied for the influence of pressure on the bulbs of the unprotected thermometers employed by them, give results which are remarkably accordant with our own; so that it may be stated with confidence that the temperature of the deeper parts of the North Atlantic sea-bed is but a very few degrees above the freezing-point.

Now a glance at the North Polar region, as laid down either on a globe or any projection of which the Pole is the centre, shows that the Polar basin is so much shut in by the northern shores of the European, Asiatic, and American continents, that its only communication with the North Atlantic basin—besides the circuitous passages leading into Hudson's and Baffin's Bays—is the space which intervenes between the eastern coast of Greenland and the north-western portion of the Scandinavian peninsula. If, therefore, there be any such general interchange of Polar and Equatorial water as that for which we have argued, the Arctic current must flow through the deeper portions of this interspace, at the north of which lies Spitzbergen, whilst Iceland and the Faroes lie in the middle of its southerly expanse. Now in the channel that lies between Greenland and Iceland, the depth is such as to give a free passage to such a frigid stream; but between Iceland and the Faroe Islands there is no depth so great as 300 fathoms at any part, except in a narrow channel at the south-east corner of Iceland; so that an effectual barrier is thus interposed to any movement of frigid water at a depth exceeding this. A similar barrier is presented, not merely by the plateau on which the British Islands rest, but also by the bed of the North Sea; the shallowness of which must give to such a movement a not less effectual check than would be afforded by an actual coast-line uniting the Shetland Islands and Norway. Consequently, it is obvious that a flow of ice-cold water, at a depth exceeding 300 fathoms from the surface, down the north-eastern portion of this interspace, *can* only find its way southwards through the deeper portion of the channel between the Faroe and Shetland Islands; which will turn it into a W.S.W. direction between the Faroe Islands and the north of Scotland, and finally discharge such part of it as has not been neutralized by the opposing stream coming up from the south-west, into the great North-Atlantic basin, where it will meet the Icelandic and Greenland currents, and unite with them in diffusing frigid waters through its deeper portion. In thus spreading itself, however, the frigid water will necessarily mingle with the mass of warmer

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water with which it meets, and will thus have its own temperature raised, whilst lowering the general temperature of that mass; and hence it is that we do not find the temperature of even the greatest depths of the Atlantic basin nearly so low as that of the comparatively shallow channel which feeds it with Arctic water.

It may be questioned, however, whether the whole body of Arctic water that finds its way through the channels just indicated could alone maintain so considerable a reduction in the temperature of the enormous mass which lies below 1,000 fathoms in the Atlantic basin; subject as this must be to continual elevation by the surface-action of the sun on its southern portion. And as the few reliable observations on deep-sea temperature under the equator indicate that even there a temperature not much above 32° prevails, it seems probable that part of the cooling effect is due to the extension of a flow of frigid water from the Antarctic Pole, even north of the Tropic of Cancer. Of such an extension there is evidence in the temperature soundings recently taken in H.M.S. *Hydra* between Aden and Bombay, where the cooling influence could scarcely have been derived from any other source than the Antarctic area.[1]

The unrestricted communication which exists between the Antarctic area and the great southern ocean-basins would involve, if the doctrine of a general oceanic circulation be admitted, a much more considerable interchange of waters between the Antarctic and equatorial areas, than is possible in the northern hemisphere. And of such a free interchange there seems adequate evidence; for it is well known to navigators that there is a perceptible "set" of warm surface-matter in all the southern oceans towards the Antarctic Pole; this "set" being so decided in one part of the Southern Indian Ocean, as to be compared by Capt. Maury to the Gulf Stream of the North Atlantic.[2] Conversely, it would appear from the application of the necessary pressure-correction to the temperatures taken in Sir James Ross's Antarctic expedition, the voyage of the *Venus*, &c., at depths greater than 1,000 fathoms, that the bottom-temperature of the deepest parts of the southern oceanic basin really approaches the freezing-point, or is even below it. And if the temperature of the deeper portion of the *North* Pacific Ocean should be found to exhibit a depression at all corresponding to that of the North Atlantic, it must be attributed entirely to the extension of this Antarctic flow; since the depth of Behring's Strait, as well as its breadth, is so small as to permit no body of Arctic water to issue through that channel.

If further observations should substantiate the *general diffusion of a temperature not much above the freezing-point over the deepest portions of the ocean-bed, even in intertropical regions*, as a result of a general deep movement of Polar waters towards the equator, forming the complement of the *surface*-movement of equatorial water towards the poles, it is obvious that such diffusion must exert a very important influence on the distribution of animal life; and, in particular, that we may expect to meet with forms which have hitherto been reputed essentially Arctic, in the deep seas of even the intertropical region, and again in the shallower waters of the Antarctic area. Such, there is strong reason to believe, will prove to be the case. In his recent annual address as president of the Royal Society, Sir Edward Sabine cites observations on this point made by Sir James Ross in his Antarctic expedition, as confirmatory of the view entertained by that distiuguished navigator, "that water of similar temperature to that of the Arctic and Antarctic seas exists in the depths of the intermediate ocean, and may have formed a channel for the dissemination of species." The "similar temperature" believed by Sir James Ross to have had this general prevalence, seems to have been 39°; whereas the observations made in the *Porcupine* expedition distinctly prove that a temperature even below 30° may be conveyed by polar streams far into the temperate zone, and that the general temperature of the deepest part of the North Atlantic sea-bed has more of a polar character than he supposed.

Again, the deep-sea dredgings of the *Porcupine* expedition have shown that many species of mollusks and crustacea previously supposed to be purely Arctic, range southwards in deep water as far as those dredgings extended—namely, to the northern extremity of the Bay of Biscay; and it becomes a question of high interest whether an extension of the same mode of exploration would not bring them up from the abysses of even intertropical seas.

Now, as there must have been deep seas at all geological epochs, and as the physical forces which maintain the oceanic circulation must have been in operation throughout, though modified in their local action by the particular distribution of land and water at each period, it is obvious that the presence of Arctic types of animal life in any marine formation cannot be accepted as furnishing evidence *per se* of the general extension of glacial action into temperate or tropical regions. How far the doctrines now current on this point may need to be modified by the new facts now brought to bear on them, it will be for geologists to determine; the question may be left in their hands with full assurance of a candid reception of the fresh evidence now adduced.—*Lecture delivered before the Royal Institution.*

[1] The lowest temperature *actually observed* in these soundings was 36½°. The temperature of 33½° given in the previous discourse, as existing below 1,900 fathoms, proves to have been only an *estimate* formed by Captain Shortland under the idea that the rate of reduction observed at smaller depths would continue uniform to the bottom, which the serial soundings of the *Porcupine* prove to be by no means the case.

[2] *Physical Geography of the Sea*, §§ 748–750.

ON COMETS AND METEORS.

BY DANIEL KIRKWOOD, LL.D.,

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IN TWO PARTS.—PART II.

THE fact that the August meteors, which have been so often subsequently observed, were first noticed in 811, renders it probable that the cluster was introduced into the planetary system not long previous to the year 800. It may be also worthy of remark that the elements of the comet of A.D. 770 are not very different from those of the August meteors and the third comet of 1862.[1]

Adopting Struve's estimate of the sun's orbital velocity, we find the diameter of the nebula traversed in 500 years to be fourteen times that of Neptune's orbit.

It is remarkable that, with the exception of Mars, the perihelia of the orbits of all the principal planets fall in the same semicircle of longitude—a fact which can hardly be regarded as accidental. Now, if the orbits were originally circular, the motion of the solar system through a nebulous mass not of uniform density would have the obvious effect of compelling the planets to deviate from their primitive orbits and move in ellipses of various eccentricities. It is easy to perceive, moreover, that the original perihelion points of all the orbits would be on that side of the system which had passed through the rarer portion of the nebulous mass. We have thus a possible cause of the eccentricity of the planetary orbits, as well as of the observed distribution of their perihelia.[2]

4. The particles of a cometic mass, being at unequal distances from the sun, will tend to move at different rates and in somewhat different orbits. This tendency will gradually overcome the feeble attractive force between the particles themselves. The most distant parts will thus become separated

[1] The interval between the perihelion passage of 770 and that of 1862 is equal to nine periods of 121·36 years. Oppolzer's determination of the period of 1862 III. is 121·5 years. Hind remarks that the elements of the comet of 770 are "rather uncertain," but says "that the general character of the orbit is decided." It may be worthy of remark that a great meteoric shower, the exact date of which has not been preserved, occurred in 770.

[2] This suggestion is due to R. A. Proctor, F.R.A.S., the distinguished author of *Saturn and its System*.

from the nucleus, and move in independent orbits. The motion of such meteoric matter will be in the same plane with that of the parent comet; the orbit of the former, however, being generally exterior to that of the latter. The connection recently discovered between comets and meteors, and especially the fact that the period of the November group is somewhat greater than that of the comet of 1866, are in striking harmony with the views here presented.

5. Owing to this loss of matter, periodic comets must become less brilliant, other things being equal, at each successive return—a fact observed in regard to the comets of Halley and Biela.

6. The line of apsides of a large proportion of comets will be approximately coincident with the solar orbit. The point towards which the sun is moving is in longitude about 260°. The quadrants bisected by this point and that directly opposite extend from 215° to 305°, and from 35° to 125°. The number of cometary perihelia found in these quadrants up to July, 1868 (periodic comets being counted but once) was 159, or 62 per cent.; in the other two quadrants, 98, or 38 per cent.

This tendency of the perihelia to crowd together in two opposite regions has been noticed by different writers.

7. Comets whose positions before entering our system were very remote from the solar orbit must have *overtaken* the sun in its progressive motion; hence their perihelia must fall for the most part, in the vicinity of the point towards which the sun is moving; and they must in general have very small perihelion distances. Now, what are the reserved facts in regard to the longitudes of the perihelia of the comets which have approached within the least distance of the sun's surface? But three have had a perihelion distance less than 0·01. *All* these, it will be seen by the annexed table, have their perihelia in close proximity to the point referred to.

I. *Comets whose Perihelion Distances are less than* 0·01.

Perihelion Passage.	Per. Dist.	Long. of Per.
1. 1668, Feb. ..... 28d. 13h.	... 0·0047	... 277° 2′
2. 1680, Dec. 17 23	... 0·0062	... 262 49
3. 1843, Feb. 27 9	... 0·0055	... 278 39

In table II. all but the last have their perihelia in the same quadrant.

II. *Comets whose Perihelion Distances are greater than* 0·01, *and less than* 0·05.

Perihelion Passage.	Per. Dist.	Long. of Per.
1. 1689, Nov. ..... 29d. 4h.	... 0·0189	... 269° 41′
2. 1816, March 1 8	... 0·0485	... 267 35
3. 1826, Nov. 18 9	... 0·0268	... 315 31
4. 1847, March 30 6	... 0·0425	... 276 2
5. 1865, Jan. 14 7	... 0·0260	... 141 15

The perihelion of the first comet in table III. is remote from the direction of the sun's motion; that of the second is distant but 14°, and of the third 21°.

III. *Comets whose Perihelion Distances are greater than* 0·05, *and less than* 0·1.

Perihelion Passage.	Per. Dist.	Long. of Per.
1. 1593, July ..... 18d. 13h.	... 0·0891	... 176° 19′
2. 1780, Sept. 30 22	... 0·0963	... 246 35
3. 1821, March 21 12	... 0·0918	... 239 29

With greater perihelion distances the tendency of the perihelia to crowd together around the point indicated is less distinctly marked.

8. Few comets of small perihelion distance should have their perihelia in the vicinity of longitude 80°, the point opposite that towards which the sun is moving. Accordingly we find, by examining a table of cometary elements, that with a perihelion distance less than 0·1, there is not a single perihelion between 35° and 125°; between 0·1 and 0·2, but 3; and between 0·2 and 0·3 only 1.—*Paper read before the American Philosophical Society*, Nov. 19, 1869.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From March 13th to 26th, 1870.

[The following Table includes the returns for two weeks. Last week's list did not reach us till we had gone to press.—Ed. *S. O.*]

Name.	Country.	How obtained.	Where placed in Gardens.
1 Common Seal (Phoca vitulina) ♂	British Islands	Purchased	Seal Pond
1 Indian Brush-tailed Porcupine (Atherura fasciculata)	Assam	Presented by Dr. Jerdon	Small Mammal House
1 Peacock Pheasant (Polyplectron chinquis)	Burmah	Deposited by Dr. Jerdon	Pheasantry
1 Ring-necked Parrakeet (Palæornis torquata)	India	Presented by Mrs. Eldred	Parrot-house
2 Fat-tailed Sheep (Ovis aries) ♂ and ♀	Ditto	Presented by Capt. Parker	Top Yard
1 Plicated Hornbill (Buceros plicatus) ♂ *	Sumatra	Purchased	Eastern Aviary
1 Ditto ditto ♀ *	Malacca	Ditto	Ditto
1 Slender Hornbill (Buceros gracilis)*	Sumatra	Ditto	Ditto
1 Concave Casqued Hornbill (Buceros bicornis)	India	Ditto	Ditto
1 Pair of Rufous-tailed Pheasants (Euplocamus erythropthalmus)	Malacca	Ditto	Pheasantry
1 Indian Antelope (Antilope cervicapra) ♂	India	Presented by Col. H. J. Smythe	Top Yard
2 Concentric Terrapins (Emys concentrica)	North America	Presented by H. Arthur, Esq.	Reptile-house
1 Snow Bunting (Plectrophanes nivalis)	Europe	Presented by F. Bond, Esq., F.Z.S.	Western Aviary
1 White-headed Sea Eagle, young (Haliætus leucocephalus)	North America	Presented by A. G. Yeatman, Esq.	Winter Aviary
1 Teguexin Lizard (Teius teguexin) [and ♀	Buenos Ayres	Presented by G. Wilkes, Esq., C.M.Z.S.	Reptile-house
2 Weasel-headed Armadillos (Dasypus encoubert) ♂	Ditto	Ditto	Anteater's House
1 Violaceous Night Heron (Nycticorax violaceus)	Ditto	Ditto	Eastern Aviary
4 Burrowing Owls (Pholeoptynx cunicularia)	Ditto	Ditto	Owl's Aviary
1 Green Monkey (Cercopithecus callitrichus) ♂	West Africa	Deposited by Lady Wilmot	Monkey-house
1 Marsh Ichneumon (Herpestes paludosus) ♂	South Africa	Purchased	Small Mammal House
1 Caracal (Felis caracal)	India	Ditto	Ditto
2 Aoudads (Ovis tragelaphus) ♂		Born in the Menagerie	Sheep Sheds
1 Grey Wagtail (Motacilla boarula)	British Islands	Purchased	Fish-house
1 Blue-bonnet Parrakeet (Psephotus hæmatogaster)	Australia	Received in Exchange	Parrot-house
3 Golden-eyes (Clangula glaucion) 2 ♂ and 1 ♀	Europe	Purchased	Three Island Pond
1 Tufted Duck (Fuligula cristata) ♂	Ditto	Ditto	Ditto
1 Wood-loving Antelope (Cephalophus sylvicultrix) *	West Africa	Received in Exchange	Gazelle Sheds
1 Red-headed Fruit Pigeon (Treron calva)	Ditto	Ditto	Western Aviary
2 Lions (Felis leo) ♂ and ♀	Babylonia	Deposited by Capt. Newman	Carnivora-dens
1 Indian Ratel (Mellivora indica) ♂	India	Presented by Dr. Anderson, F.Z.S.	Raccoon's Cages
1 Ocelot (Felis pardalis) ♀	America	Presented by Vice-Admiral Sir Sydney Dacres, K.C.B.	Small Mammal House

♂ Male. ♀ Female. * Never previously exhibited.

WHAT WAS DONE IN THE SEVERAL BRITISH OBSERVATORIES IN 1869.

In Four Parts.—Part II.

Cambridge Observatory.

THE meridian observations with the transit instrument and mural circle were made in the usual order until July 10th when the former instrument was dismounted in preparation for the reception of the new transit-circle. These were chiefly confined to observations of standard stars for the determination of clock and instrumental errors, of Mars near opposition, and of the sun near the equinoxes and solstices. Since July 10th the time has been approximately found by transits taken with the telescope of the mural circle. Winnecke's comet was observed on thirteen separate nights in May and June with the Northumberland equatorial; on each night it was compared with several stars carefully selected from catalogues. The results are found to be very accordant. Both the equatorials have been used in observing occultations.

The meteorological observations have been made at the usual hours of 9 a.m. and 3 p.m.

The courses of a few meteors were registered in August, but the sky was unfavourable in November.

Steady progress has been made during the year with the calculations and preparations for the press; the observations of more than 1,000 stars, which were made in 1864 and 1865 with the Northumberland equatorial, by means of the square bar micrometer, for the purpose of completing the Markree zones, have been reduced, and the mean places obtained for the beginning of 1865.

The observations of Winnecke's comet have been reduced, and the comet observations of former years are now being arranged for the press. The transit reductions are completed. The mural circle reductions are completed to the end of 1866.

All the preparations have been made for some time past for the new Transit-circle, the arrival of which has been most unaccountably delayed, as in October last it was expected.

Glasgow Observatory.—The operations at the Glasgow Observatory during the past year have been essentially the same as those of preceding years. In addition to stars chosen from the usual list, several of the minor planets have been observed with the transit circle. The Ochtertyre equatorial has been employed in observing such of the minor planets as may be conveniently seen with it, and do not come within the range of the meridian instrument. A few observations of Brorsen's and Winnecke's comets have also been obtained with the same instrument.

True time continues to be transmitted in the usual manner to the city and port of Glasgow. A system of meteorological observations, conducted by means of self-recording instruments, was established at the Observatory in the beginning of 1868, under the auspices of the Meteorological Committee of the Royal Society, and has continued since in active operation.

Work done with the Photoheliograph at the Kew Observatory.—The first instalment of the measurements and reductions of the Kew sun-pictures taken during the two years 1862 and 1863, containing also the areas of the observed groups and an explanation of the methods followed in the working out of the observations, has been published in the last volume of the *Transactions of the Royal Society*. Nearly 150 separate copies of the paper, printed partly at the private expense of Mr. Warren de la Rue, were distributed, chiefly to foreign observatories, scientific institutions and distinguished astronomers and physicists.

The second instalment, containing the heliographic positions of the sun-spots observed from the beginning of 1864 to the and of 1866, is nearly ready and will be presented to the Royal Society at an early date during the present session.

Some investigations were also made last year on the influence which a refracting medium of considerable density would have on the apparent size and figure of the sun, and the time of rotation, as calculated from spots at different latitudes. The preliminary discussion has led to the conviction that a comparison of the times of rotation as derived from spots while they are near the limb, with those deduced from the same spots when near the centre, will throw much light on several important questions connected with solar physics. The matter will be exhaustively investigated in the general discussion of the Kew results.

During the present year it is intended to bring, if possible, the work of the measurements up to date. The scarcity of spots during 1867 and 1868 was such, that the pictures of these years may be measured in a comparatively short time; and it is hoped that by completing, by the end of this year, the observations made up to at least the end of 1869, that the greater part of the succeeding years may be devoted to as careful a discussion of the whole work as is required by the importance of the astronomical and physical problems involved in it.

Messrs. De la Rue, Stewart, and Loewy, state that the reductions of Hofrath Schwabe's observations are now finished. By comparing his observations with those taken by Carrington, and also with the sun-pictures taken at Kew, they arrived at very favourable conclusions regarding the accuracy of the delineations of the distinguished German observer. Beginning with the year 1832, they have measured the spotted area of all his pictures up to the time when Carrington's series commenced. From the results obtained they have, first of all, deduced fortnightly views, and in the next place, in order to get rid of the more transitory fluctuations, they have taken a series of those monthly views corresponding to the middle and end of each month, from the beginning of 1832 till the end of May, 1868. Putting these results into a graphical form, they have obtained a curve exhibiting only the irregularities of comparatively long periods, and from the curve by the ordinary method of equalization, they have deduced an equalized curve exhibiting the decimal period of solar disturbances.

They find therefrom the following epochs of maximum and minimum spotted area:—

Minimum	Nov. 28.....1833	Minimum	April 21.....1856
Maximum	Dec. 21.....1836	Maximum	Oct. 7.....1859
Minimum	Sept. 21.....1843	Minimum	Feb. 14.....1867
Maximum	Nov. 14.....1847		

From these dates it will be perceived that (as has been already observed) the time between the minimum and maximum is always less than that between the maximum and next minimum.

It will also be noticed that the whole period is not always of uniform length; nevertheless, judging from what has gone before, they believe that they are perhaps entitled to conclude that the approaching minimum will not be delayed much beyond the end of this year. It ought also to be remarked that, in all the three series, the progression from maximum to minimum is not a simple progression, but exhibits in each case traces of a secondary maximum.

Finally, they have examined these results for traces of the action of the planets upon sun-spots, and pursuing the method indicated in their preliminary researches, they derived the following table, as exhibiting the evidence deduced from all the observations between 1832 and 1868:—

Relative Planetary Separation.	Excess or Deficiency of Spotted Area. Jupiter and Venus—Mars and Mercury.	
Between 0° and 30°	+ 881	+1675
30 ,, 60	— 60	— 139
60 ,, 90	— 452	—1665
90 ,, 120	— 579	—2355
120 ,, 150	— 705	—2318
150 ,, 180	— 759	—1604
180 ,, 210	— 893	— 481
210 ,, 240	— 752	+ 547
240 ,, 270	— 263	+ 431
270 ,, 300	+ 70	+ 228
300 ,, 330	+ 480	+1318
330 ,, 0	+1134	+2283

FOOD STORES IN HOROWHENUA LAKE. [See p. 309.

From this table there appears to be an excess of solar activity when either Jupiter and Venus or Mars and Mercury are together, and a deficiency when they are 180° apart. We see also that the progression of the numbers is regular in each case and very similar in the one case to what it is in the other. —*Annual Report of the Council of the Royal Astronomical Society.*

REVIEWS OF BOOKS.

Ti Ika A Maui; or, New Zealand and its Inhabitants. Second Edition. By the Rev. Richard Taylor, M.A., F.G.S. London: Macintosh. 1870.

[First Notice.]

THERE is not, perhaps, on the whole face of the globe a race whose history, origin, habits, and character present a livelier interest to the Anthropologist than that of New Zealand. Whether we regard the remarkable intelligence and high mental culture which even the first New Zealand savages displayed when taken on board Cook's vessel, or the curious circumstance that the traditions of the people show them to have been in their pre-cannibalism period a more civilized race than when first discovered by the great circumnavigator, the New Zealander, as a type of primitive man, is a study of the highest moment to Science. It is strange, therefore, that, with the exception of some communications to special journals, so little has been done towards a complete Anthropological sketch of the New Zealand savage. The Central African has been done to death; the American Indian has long since passed from our literature; the races of the Eastern Archipelago have found an eloquent and philosophical historian in Mr. Wallace; but the New Zealander has not had full justice done to him till the appearance of Mr. Taylor's work, which we are happy to see now before us in its second edition, and which, coming as it does from a missionary and man of science, is a truthful and worthy record of the habits, manners, and traditions of the Maories.

The author commences his treatise with some general observations on savages, which we think he would have done well to have omitted, since they have led him into speculations which he cannot support. For example, in speaking of the present degenerate condition of the Maori, as contrasted with his highly civilized state when first discovered, the author advances this as a fact against progressive development. This is at once shallow, and out of accordance with fact. The law of progressive development exacts as one of its very elementary conditions that, while certain favoured races shall survive, others, less able to contend with external circumstances, shall degenerate and die out.

But, passing this slight misconception over, we soon come to the more valuable parts of the book, where the author gives us the results of his thirty years' observation and study of the race. One of the first points to which Mr. Taylor directs his attention is that connected with the early settlement of the present race in the islands. He shows, chiefly from the traditions of the people, that the Maories originially inhabited other islands, and that the population having become too dense, many of them emigrated in canoes, and some of the latter struck on the Ti Ika A Maui (or fish of the Maui, or

Creator). Here they met a race more of the African type, which they eventually drove out and dispossessed, but remnants of which are still to be found among the Maories. We fear that a good many of the author's speculations as to the origin of these races will meet with disapproval, but they are nevertheless interesting, and are thus summed up in the author's words:—

"There appears, therefore, to be one grand conclusion arrived at on this deeply interesting subject of inquiry, which is that the Pacific has been chiefly peopled by two races—the Melanesian and Polynesian—although others may have contributed to do so in a smaller degree. That the Melanesian was by far the most ancient of the two, and both entered the Pacific from contrary directions. That whenever they came into contact with each other the lighter coloured subdued and dominated over the other. The black arrived from the west; they may be clearly traced through Australia and New Zealand towards the south, and through India with its islands, also China, Japan, the Philippines, and all those islands comprising the Indian Archipelago, until by New Guinea and New Caledonia they entered the Pacific."

Mr. Taylor presumes that both races originally started from Egypt, and he traces the respective routes pursued by them with a detail which shows us how dangerous are the paths of enthusiastic theorists. The subjects of civilization and religion next occupy the attention of the author, but his observations on these points are more missionistic, if we may use the word, than specially connected with Science. In this way the first hundred pages of the book are occupied, and at this landmark we must postpone our remarks on the volume to a future number. We may, however, draw attention to the fact that the work is very admirably illustrated with numerous excellent drawings by the author's pencil. One of these (kindly lent us by the publishers) is seen on p. 307, and represents the appearance of Lake Horowhenua, as seen many years ago by Mr. Taylor. The lake-houses on piles recall forcibly many of the dwellings figured in Keller's excellent treatise, but at the date Mr. Taylor sketched them these erections were merely used as food-stores. Since then they have altogether passed away.

The Philosophy of the Bath; with a History of Hydro-Therapeutics and of the Hot-air Bath, from the Earliest Ages. By DURHAM DUNLOP, M.R.I.A. Dublin: Moffat.

MR. DUNLOP appears to be one of those gentlemen who, with a very limited knowledge of physiology and advanced therapeutics, think that modern medicine is a delusion and a snare, and that a book written to expose the doctors is not only a very laudable proceeding, but one which is likely to insure the utter demolition of the disciples of Galen. When we further say that the author dedicates this volume of *fulmen brutum* to Dr. Barter, of Blarney, whom he regards as the apostle of the true faith, and the pioneer of philosophic therapeutics, we have said enough to give the educated reader an idea of the nature of the work. It is the clumsiest piece of special pleading we have ever read; and to any one with a knowledge of what modern scientific medicine has done and is doing, the book carries its own refutation with it. Medical men acknowledge the advantage of the hot-air bath in particular cases; but those who would regard it as a *panacea* would have to argue in the flippant style and with all the prejudice and warped judgment which the author of this work displays.

Christianum Organum; or the Inductive Method in Scripture and Science. By JOSIAH MILLER, M.A., with an Introduction by JOHN HALL GLADSTONE, Ph.D., F.R.S. London: Longmans. 1870.

UNQUESTIONABLY the best part of this work is the calm and temperate preface which that clever physicist, Dr. Gladstone, has written for it. Dr. Gladstone's remarks deserve the attention of thoughtful men, whether believers or sceptics, for they show that the writer appreciates the terrible difficulties which thinkers often encounter, and they do not convey that brand of burning brimstone sort of feeling which is unhappily characteristic of too many of our divines. The author, Mr. Miller, tries to show the advantage of the inductive method in religion, and proves that it is equally applicable to Science and Theology. His arguments so far are sound. We do not gainsay them. But we know how the sceptic will answer them. He will say, "Firstly, may not the inductive method be a very dangerous one, both in Science and Religion?" and if this be answered in the negative, he will say, "Secondly, in using the inductive method in Science we start with phenomena, and argue from them. You start in Religion with an assumption, viz., that certain writings are revealed. Go a step farther back and reason purely from phenomena, as the scientific man does, and what will it lead to?" We take no interest in books of this kind. We think they often make infidels, knowing, as we do, that the only safe basis of Religion is Faith.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

The November Meteors and the Sun.—*From* R. A. Proctor, B.A., F.R.A.S.

Sir,—This discussion grows wearisome. Mr. Elvins does not recognize the requirements of his own theory. He associates the 33-year period of the November meteors with the 11-year sun-spot period. Yet he only gets his meteors into the sun by disturbing their regular orbital motion, and so spoiling their periodicity. As a matter of fact the meteors do *not* "sometimes pass near the outer planets Saturn, Jupiter, and Mars." They come nearest to Mars, but are always full twelve millions of miles from him. But it is useless to touch on one error in a theory which is absurd throughout.

That meteors fall into the sun in countless millions has long been recognized as a necessary conclusion from the observed number of meteoric systems encountered by the earth, and the deduced existence of millions of other systems. Some few of the November meteors, passing very close to Uranus or the earth (the only planets which can sufficiently affect them), may reach the sun after long wanderings; but there would remain no trace of periodicity in such occurrences. The number of meteors so disturbed must be very small, since Uranus is only suitably situated once in more than eighty years, the earth, whose disturbing power is very far smaller once a year; and not one meteor out of thousands would be disturbed so as to leave the general track.

It is, however, the most complete waste of time to consider such a theory, and I must decline to continue the discussion. I did not promise, as Mr. Elvins says, to "state other objections." I thought the one I stated so palpable that Mr. Elvins might be able to recognize its force, and so be advised to waste no further time over his fancies. That there are other objections severally fatal to his notions any tolerably advanced student of astronomy can inform him.

March 25. Yours truly, Richard A. Proctor.

Sir W. Thomson *versus* Geology.—*From* P. W. Stuart Menteath.

Sir,—The Uniformitarians are represented by Sir W. Thomson as a particular school, who "have brought so much of British popular geology into direct opposition to the principles of natural philosophy." Now, at least since the time of Hutton, Uniformitarianism has been steadily growing as the leading idea of geology, and its chief safeguard against rash hypothesis and conflicting speculations. During the greater part of that time it was certainly not found to be in direct opposition to the principles of natural philosophy. But a few years ago Sir W. Thomson propounded a dogma, viz., the *universal* principle of dissipation of energy; this dogma he has endeavoured to support by the statement that he knows nothing against it (of course, true, as he rejects without examination such evidence as may be adduced against it), and by a selection of certain isolated passages from the Bible.[1] It is to this dogma, and not to the principles of natural philosophy, that Uniformitarianism is opposed; and it is precisely because Sir W. Thomson, in attempting to frame a *universal* principle, has not considered, but rejected, the evidence from geological facts, which "do certainly belong to the law of Nature," that he has recently brought himself, and a few disciples of his, into "direct opposition to the principles of" geology. And as undeniable fact, stated in simple language, has usually been found more valuable than questionable fact stated in obscure technicalities, it is not surprising that true geology should be "popular." So is Christianity, so is poetry, so is truth; and though the *North British Reviewer* seems to take popularity as of itself a term of reproach, he has not given any reasons for believing it to be so. Certainly, geologists are not infallible, and doubtless mistakes and rash statements can be selected in all their works; but nearly all the physicists and astronomers of fifteen years ago, and several at least of those now living, could be cited as holding doctrines in contradiction with those of Sir W. Thomson. And if any one were desirous of supporting a particular dogma against the undulatory theory of light, he might cite a roll of great names, from Newton to Brewster, reject the evidence for it without criticism, ask "on what calculation is this opinion founded?" when the results of observation were cited to him,—and get laughed at for his pains. The citation of great names may frighten off fair criticism, just as the introduction of mathematical calculations may frighten off those fully competent to examine the real physical evidence on which the whole question turns, and without full valuation of which the calculations are utterly impertinent. But no great names, and no mathematical calculations, can convert vague assumptions into a "sober scientific certainty,"[2] or obtain a "quite certain" conclusion from speculations on obscure and questionable evidence.

If Leibnitz and Newton ("true geologists" according to Thomson) *really* regarded an imaginary cosmogony as a legitimate explanation of a few obscure facts, on the other hand nearly all great reasoners, from Aristotle to Malebranche, Spinoza, and the Scotch school, have rejected such explanations, and shown their absurdity. And when Sir W. Thomson now revives a cosmogony, calls it a "sober scientific certainty," and, in consequence, instead of examining rejects geology, we are sorry for him, and must regard his "position" as an example of the evil influence of mathematical training—such as nearly all great thinkers have condemned, such as we have recent examples of the pernicious effects of, such as Professor Huxley has lately dwelt on, and Professor Sylvester has defended by an argument strictly parallel to this:—Because a man who invents or improves a barrel-organ must be more or less intellectual, therefore, organ-grinding is an excellent mental training, and a highly intellectual occupation; with illustrations from space of four dimensions, the relation of age to correct reasoning, anecdotes of private life, and the music of the future.

Now, what are Sir W. Thomson's references to the works of geologists worth? Let those contained in his *Reply* be examined; those I mean which might seem to lend countenance to his views:—

1. Professor Haughton's *Manual*.—In this elementary work I find the author treats the theory of Darwin with ridicule and contempt, because, as he says, he is a "man and not an ape" (a *petitio principii*); he considers "loose theories" to be supported by "the shallow metaphysical philosophy of the Scotch school"; and he remarks that geology "is like the study of archæology, and not of history, and therefore a certain amount of license and poetry must be allowed to the speculator in it that would be forbidden to the accurate historian." So I cannot see that any chance passage in Professor Haughton's *Manual* can have much weight.

2. If Sir W. Thomson will explain what he means by calling Professor Phillips's expression of opinion a "careful analysis," its "marked contrast" to the remarks of Darwin might be profitably discussed. It *may* be that a hundred million years would suffice for the operations considered by Professor Phillips and Mr. Geikie; but more definite considerations show a balance of probability the other way, and I argue that Sir W. Thomson has brought nothing to affect that balance.

If Sir Roderick Murchison, or any other geologist, will produce any stratigraphical evidence that will establish, *without taking catastrophism for granted*, the grander *intensity* of causation in former epochs, then his first remarks might have weight in the present discussion. Such evidence has never been adduced; a roll of names may be cited on the opposite side; and it is obvious that, *at least*, the grounds for a decision must be sought elsewhere. The "traveller" has again and again cited Alpine gorges as evidence of "former catastrophes;" but Professor Tyndall, a practised observer, takes the trouble to examine the gorges, and writes in 1869 of that of Pontresina, "Like all others I have seen, it is a chasm of erosion." Having carefully explored on foot nearly the whole Pyrenean chain, I have never found such "clear and unmistakable signs of former catastrophes" as Sir Roderick Murchison mentions; but many supposed examples of catastrophe have been pointed out to me, and careful examination has convinced me that they were evidences of the contrary. Nothing is easier than hastily to refer a valley or fissure to some convulsion; but yet the more carefully it be examined the more it may afford evidence of the contrary. In one case I was nearly referring a deep and narrow gorge to fracture, because it followed a line of fault, and the evidence of aqueous erosion was not satisfactory; but I found the gorge end at another gorge transverse to the first, and on the opposite wall of rock the dislocation was clearly marked—its sides not an inch apart; so as streams *must* erode, and there was no evidence to the contrary, I naturally concluded that the gorge had been worked out by the stream. "Convulsion was as evident in the structure of the mountains as in their forcible separation," says Mr. Bayard Taylor, of the gorges of

[1] "Energy," Thomson and Tait.—*Good Words*, 1862.

[2] "Energy," Thomson and Tait.—*Good Words*, 1862.

the Rio Segre. Certainly, by no gorges in the whole Pyrenees is convulsion more strongly suggested to the imagination; certainly, few "travellers" could be more intelligent than Mr. Bayard Taylor. But as I have most carefully studied the gorges of the Rio Segre, as well as the structure of the whole neighbouring country, not simply recording a passing impression, but spending many days in seeking evidence regarding the structure and origin of the mountains and gorges, I have not the slightest hesitation in affirming that there is no evidence of convulsion, and such evidence of the contrary, that if we reject it, we must reject the simplest facts that are accepted by all geologists.

If *time* be granted, geological phenomena can be consistently explained; if not, the assumptions and contradictions introduced are endless. The last remarks quoted from Sir R. Murchison relate especially to chemical geology. They are simply inconsistent with all that has been done in that science. The processes of metamorphism that have been accomplished in laboratories, or observed in the arts or in nature, are so numerous that the difficulty among those who study these matters is to select those most appropriate in each particular case; and unless it be taken for granted that chemical processes were formerly subject to a law of fits and starts, it remains to be shown, not so much *how* metamorphism *could* have taken place as *how* it *could not* have taken place. The "theorist" is he who rejects the vast amount of evidence accumulated on this question, and refers to fanciful hypotheses, like that of Von Buch regarding dolomite. The fact that many do so is strong evidence against Catastrophism. Now, regarding these last quotations from Sir R. Murchison, and especially the last sentence regarding grand ranges of limestone changed "*all at once*, I would remark that their date is 1867, and that in February, 1868, Sir R. Murchison said, regarding an elementary lecture by Mr. D. Forbes, that he "felt as yet incompetent to offer any opinion upon the great chemical questions treated of in the paper;" and I would ask what would be thought of a scientist who, proposing to *reform* our notions regarding the spectrum analysis of the heavenly bodies, should ignore the researches of Stokes, Huggins, Secchi, Kirchhof, and others who have devoted themselves to such matters, and cite some passages from the works of an astronomer whose special field was peculiarly remote from such investigations?

I have used above the words "might seem to countenance his views," for the notion of former convulsions formed a part of the Uniformitarianism of Hutton; and Sir W. Thomson has mentioned no geological evidence for the secular cooling of the earth. "It cannot be reasonably urged that a hotter sun is not a probable explanation of the supposed warmer climate of the palæozoic ages," says Sir W. Thomson. But what is a *probable explanation* of a strongly controverted *supposition* worth. Local changes in climate are well established; but the best established evidence of general change is the evidence for the *former colder* climate of the glacial epoch. There seems also some evidence that during *nearly all* the geological ages the general climate was, *on the whole*, more equable than it has been since the glacial epoch; but that the climate of the palæozoic ages was warmer than that of the succeeding periods there is no evidence whatever. If the *North British Reviewer's* estimate of Sir W. Thomson's position ("that natural philosophy already points to a period of some ten or fifteen millions of years") be fair, we may thank Sir W. Thomson for having afforded to *all* geologists a *reductio ad absurdum* of certain rash and vague speculations that still linger in some geological works.

Now, do Sir W. Thomson's references to geological works strengthen or weaken his position? If it be admitted that they lend it no support, that is all I care for.

No one disputes that Sir W. Thomson is a highly competent master of the art of drawing conclusions by mathematical reasoning. But as he has not shown that the geologists have drawn their conclusions by erroneous reasoning, the question of certainty of reasoning is not pertinent to the discussion. Even the conclusions for which the most complete certainty is claimed—even the papal decisions—have usually contained, expressed or implied, the limitation *Si ita est, si preces veritate nitantur*. And if the reasoning is certain, there can be no doubt that the value of the conclusions depends *strictly* on the value of the premises: so if the premises are worthless, it follows, with mathematical certainty, that the conclusions are worthless also.

I have already indicated the value of Sir W. Thomson's premises; but the more they are examined, the more fully does their real character appear.

Internal Heat.—It is commonly stated that the mean increase of temperature is about 1° Fahr. for every 50 ft. of descent. For ordinary practical purposes this may be admitted as a fact. But to raise it into an absolute axiom and draw conclusions from it against the other facts of geology is a very different matter. In proportion as we would draw valuable conclusions from it we must know what it means: this geologists do know, and therefore they do not draw utterly unjustified conclusions from it. The statement means that observations have been made to within an extreme depth of about $\frac{1}{1000}$ of the earth's diameter; and, dividing the respective depths reached by the respective gross amounts of increase of temperature, the mean result is as above. The observations have been made over only a few portions of a fourth part of the earth's surface. The results in different places have been found very different. Most of the observations have been very roughly made. It would be difficult to find more trustworthy observations than those made by Messrs. Arag and Walferdin at the well of Grenelle, and those of De la Rive at the well of Brégny: these observations showed that the rise in temperature took place at a *decreasing rate*; and most other observations do not show the *real rate* at all. Yet if the rise take place at a decreasing rate, the observations *tell against* the hypothesis of original heat; and can the decreasing rate be said to be less well established than a uniform or increasing rate. Volcanoes and hot springs *may* be due to the indefinite increase of internal heat; but it is usually admitted that they *may* be due to chemical action, friction, electricity, and other such causes. Has Sir W. Thomson given any grounds for deciding between the two views? If volcanic action have the latter origin, it is pretty obvious that the evidence from temperature in excavations may in great part be accounted for by such action. Until these matters be decided, how can an argument against Uniformitarianism be grounded on such considerations. Anyhow, there are known causes of heat in the earth; and their effect must be eliminated before the calculations from observed temperature can have any decided value. The chemical theory of Davy is certainly, at the present day, a mere man of straw, which Sir W. Thomson need not have troubled himself to attack. But that oxidation is going on in rocks is one of the best ascertained facts of chemical geology; that water percolating through rocks will become heated by friction, pressure, and chemical action can hardly be doubted; that electric currents are constantly passing through rocks is well ascertained (and terrestrial magnetism seems bound up with this fact); and that the products of volcanic action are just what we should expect on the chemical theory can scarcely be disputed. It must certainly be granted that the value of any conclusions, and especially of any calculations, drawn from observed internal temperature, is at least altogether problematical.

Sir W. Thomson's argument regarding the sun is this:—That according to Uniformitarianism the sun is a perpetual miracle, because we know of no manner in which the heat given out by the sun can be restored to it; therefore he would force us into admitting a theory to account for the sun, which theory contradicts geology, and represents the universe as strictly analogous to a machine. But:—

1. Is it more reasonable to admit that there are many things in the universe which we do not yet understand, but which *future investigation* may reveal to us; or more reasonable to admit that the evidence of geology is false? As Sir W. Thomson has not attempted to discuss the evidence adduced by our great geologists, he has thrown no light on this point.

2. As Sir W. Thomson seeks out what Uniformitarianism may, so far as we know, involve, and rejects it because it involves a miracle, may we not similarly seek out what Sir W. Thomson's theory involves, and reject it if it involves a miracle? This theory (substantially that of Descartes, Laplace, and the *Vestiges of Creation*) involves not one miracle only but many miracles. First, it involves the miracle of the dispersion of matter through space; second, the determining of particular centres of attraction in this miraculously dispersed matter; further, it involves spontaneous generation, the development of monads into vertebrates, and the innumerable other miracles required to evolve the order and the beauty of our system from a mass of cosmotic gas. I take the word miracle in the sense in which Sir W. Thomson employs it; I apply it in his theory as he has applied it in Uniformitarianism; I show that his own theory is, *on his own premises*, far more inadmissable than the other. And surely Sir W. Thomson does not really suppose that the miraculous is governed by a law that relegates to wherever it may suit the convenience of his own theories to permit it?

3. The doctrine of the universal dissipation of energy is a singular extension of an old and well-known result of induction from a certain number of facts. The statement of this principle as *universal* simply means that Sir W. Thomson finds nothing against its universality. But the obvious means of testing whether the principle be probably universal or no is to ask from geology—in which the principle of universal would necessarily make itself felt—for information on the question. The answer of geology is negative; but, instead of supposing the principle not universal, Sir W. Thomson during nearly ten years publishes the conclusion that the geologists are wrong; and during all that time he does not attempt to criticise their evidence, or to show how they may escape from the conclusions to which the patient and progressive study of Nature's footprints has conducted them.

But with much astonishment I have found Sir W. Thomson's conclusions welcomed by the *British and Foreign Evangelical Review*. The secret of this I find in an article in *Good Words* of 1862, in which Messrs. Thomson and Tait endeavour to support their cosmogony by certain isolated clauses from the Bible. This manner of utilising the Bible has been condemned by Augustine, Aquinas, Pascal, and a hundred other authorities; and of its fairness in this particular case, I think any unprejudiced reader would speedily judge. It is of a piece with the introduction of scientific patriotism, regarding Mayer, in the same article. Religious writers might do well to remember that, till

very lately, whole libraries were written against the cosmogony of Laplace; that if they are now to unwrite those libraries they will be in a strange position; and they might well pause before committing themselves to a mathematical fatalism that would engulf religion and science alike.

The existing course of nature is assumed in all our reasonings as to the past, and all attempts at cosmogony are involved in a cycle of contradictions. What that course of nature is, it is the business of the geologist and other scientists to ascertain, by patient and progressive observation, calling in the assistance of the mathematical craft when necessary, but whether by machinery or by craftsmen is indifferent; and while they acknowledge the merits of the inventors of the machinery or the craft, they refuse all claim to "proud preeminence" to the craftsmen.

But I will endeavour to sketch the grounds of Uniformitarianism in my next letter. Of course it is only by the comparison of the value of those grounds, with that of the grounds of Sir W. Thomson's "position," that the said position can be fairly estimated. This seems never to have occurred to Sir W. Thomson; but, similarly, it will never occur to modern scientists to attribute value to conclusions obtained by the simple and certain method of first begging the question.

I remain, &c.,

P. W. Stuart Menteath,

Senior Hope Scholar in Chemistry of Edinburgh University in 1864. First in the Geological Examination of the Royal School of Mines in 1865.

Carboniferous and General Ichnology.—*From* T. P. Barkas, F.G.S.

Sir,—There are few departments of palæontology more interesting and instructive, and that give a greater promise of important discoveries, than that which is known as Ichnology, and there are few phases of palæontographical research that have been so much neglected, especially in the British Islands. Since the production of those standard, but comparatively little known, works on Ichnology, entitled *Ichnology of New England*, by Professor Hitchcock; *Ichnology of Annandale*, by Sir William Jardine; and *Fossil Footprints in the Red Sandstones of Potsdam, Pennsylvania*, by Dr. J. Lea, which were published several years ago, no work specifically devoted to the elucidation of Ichnology has been issued from the press in England, and the three works above-named are so rare as not even to be found in some of the best provincial libraries in the kingdom. The discovery of animals of ornithic and reptilian types in the palæozoic formations, was originally made known by footprints, the discovery of the remains of reptiles in the Carboniferous strata was preceded by the discovery of footprints, and, for a knowledge of the general characteristics of one of the best known quadrupeds of the more recent Triassic period, Labyrinthodon, we are indebted to footprints, which, because of their hand-like aspect, were originally named Cheirotherium, but which further research, by the best known and most venerated English palæontologist, Professor Owen, was proved to belong to Labyrinthodon. Among the palæozoic sandstones of Scotland, the Mesozoic sandstones of England, and sandstones of all ages, down to and including the Silurian in America, footprints have been discovered, but so far as the transactions of scientific societies and the pages of scientific journals are concerned, we neither read of any systematic investigation of ichnite-bearing sandstones during the present day, nor of the publication or preparation of any extensive treatise on the subject of Ichnology. I believe I am right in stating that no monograph on Ichnology has yet appeared in the published *Transactions* of the Palæontographical Society, and inquirers into the interesting field of Ichnology, in the present day, are driven to consult a large variety of geological works, in which the subject is merely incidentally referred to, and in which there is an endless repetition of the same well-known and hackneyed illustrations.

I have recently had my attention specially directed to the consideration of Ichnology by there having come into my possession from the laminated sandstones of the carboniferous formation, two series of beautiful footprints, one series of which bears a considerable resemblance to the reptilian and ornithic footmarks, represented in the works already quoted, and the other and much the more perfect and extensive series is, I think, of mammalian origin, and absolutely new to science. A description of the latter specimen, with a very accurate lithographic illustration of natural size, appears in the *Colliery Guardian*, of March 11th, 1870, and the name which I have bestowed upon the producer of the impressions is *Platytherium psammobates*. The name is intended to indicate the leading known peculiarities of the supposed carboniferous mammal. The footprints are 36 in number, and are disposed in two rows, the rows are $\frac{7}{8}$ in. apart, the average length of each step does not exceed $\frac{5}{8}$ in.; the animal, therefore, was small and broad, and hence the generic name Platytherium; what is further known of the creature is that it frequented sandy shores, and trod on sand, indicating the propriety of psammobates as its specific designation. The size of the footprints does not exceed $\frac{1}{4}$ in. in length and the width does not exceed $\frac{1}{8}$ in. In form the impressions very closely resemble an elongated ace of clubs. The second series of footprints has not yet been described. The slab of sandstone on which they are impressed is $4\frac{1}{2}$ in. long, by 4 in. broad, and it contains eight ichnital impressions; they are arranged in two rows, the space between each row from inside to inside of the footprints is 1 in., the clear space between each footprint is $\frac{1}{2}$ in., the length of each footprint is $\frac{1}{4}$ in., and the width $\frac{1}{8}$ in. On the larger slab previously referred to no toes are visible, but on this which I am now describing, there are distinct indications of three toes, the animal, therefore, was probably tridactyle.

I infer from the broad, bold, cushion-like appearance of the body of the foot, and the shortness of the stride, that the impressions are not ornithic, but that they have been produced by a small broad reptile, not Batrachian, because the footprints are of equal size, but probably Chelonian. Judging by the width of the body in proportion to the length of the step, and the flat, cushion-like appearance of the body of the foot, the Chelonian hypothesis appears most probable.

Prior to the description of the ichnites now under consideration, I am not aware that footprints in Northumberland sandstone have ever been described in any scientific journal, and I have not found any reference to the subject of either local or general ichnology in the able and extensive *Transactions of the Tyneside Naturalists' Field Club*, which have been published for many years, and occupy eight thick 8vo. volumes. The only reference to fossil markings on sandstone which I have found in the *Transactions*, is a paper by Albany Hancock, Esq., in vol. iv. "On certain Vermiform Fossils," which were thought to have been produced by worms, but which Mr. Hancock showed were probably the product of crustaceans.

Those who are interested in the study of ichnology will find valuable information in any of the following works; reference is made to a large variety in order to afford inquirers an opportunity of examining a selection:—*American Journal of Sciences and Arts*, first series, vols. xxix. xxxii. xxxiii. xxxvi. xxxvii. xxxviii. and xliii. to xlix.; second series, vols. i.–vi. viii. ix. xiv. xix. xxi. xxii. xxix. xxxi. xxxiv. xxxvi. xl. xli.; *Transactions of the Royal Society of Edinburgh*, vol. xi. p. 194, containing the first paper on fossil footprints by Dr. Duncan; the *Quarterly Journal of the Geological Society*, 1852, p. 214, 1856, p. 250, pl. 4, fig. 4; vol. xii. pp. 238, 243, fig. 2. *The Geologist*, vols. i. v. vi. Murchison's *Siluria*, p. 351. Owen's *Palæontology*, p. 176. *Page's Geology*, p. 259. De La Beche's *Geological Observer*, pp. 147, 602. Dawson's *Acadian Geology*, pp. 353–358. Hugh Miller's *Sketch Book of Popular Geology*, pp. 163–168; *Testimony of the Rocks*, pp. 79–83. Hitchcock's *Outlines of the Geology of the Globe*, 1853, p. 98, fig. *a*, 72–84. Dana's *Manual of Geology*, pp. 185, 315, 415, 421, 436. Buckland's *Bridgewater Treatise*, pp. 247–253, plates 31–36. *Annals and Magazine of Natural History*, vol. xvii. 1846, p. 451.; new series, vol. vi. 1850, p. 440.

Information respecting Ichnology is scattered through other works on geology and palæontology, but it is for the most part a mere repetition of the facts contained in the works already quoted.

I remain, &c.,

Newcastle-on-Tyne. T. P. Barkas, F.G.S.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

Thursday, March 17th.—The following papers were read, but reached us too late for insertion in our last. "On the Estimation of Ammonia in Atmospheric Air," by Horace T. Brown, Esq., communicated by Dr. Frankland, F.R.S.—In the attempts that have been hitherto made to estimate the ammonia present in atmospheric air, the results arrived at by the various experimenters have differed so widely that it is still a matter of uncertainty what the quantity really is. That it is a very small amount all agree, but the extreme results on record vary as much as from 13·5 to ·01 part of carbonate of ammonium per 100,000 of air. It may therefore not be without interest to give an account of a simple method affording very concordant and, I believe, accurate results; at the same time being easy of performance and requiring but little time for an experiment.

The apparatus used consists of two glass tubes, each of about 1 metre in length and 12 millims. bore. These are connected air-tight by means of a smaller glass tube, and inclined at an angle of 5° or 6° with the horizon. Into each of the larger tubes are introduced 100 cub. centims. of a mixture of perfectly pure water and two drops of

tube engraved and sp. gr. 1·1). Through this acidulated water a measured quantity of the air under examination is slowly drawn, in small volumes, by means of an aspirator.

No porous substance must be used to filter the air, for reasons to be stated hereafter. The air is conducted into the absorption liquid through a small piece of quill tubing drawn out to a small aperture at the end immersed. This tube must be kept quite dry throughout the experiment. Great care must be taken to cleanse perfectly every part of the apparatus with water free from ammonia, and the caoutchouc plugs or corks used must be boiled for a short time in a solution of caustic soda.

The stream of air is so regulated as to allow about 1 litre to pass through the apparatus in an hour.

By covering the point of the delivery-tube laterally, each bubble is caused to burst on rising an oscillatory movement which facilitates complete absorption of the ammonia.

When from 10 to 20 litres of air have passed, the liquid is emptied from the tubes into upright glass cylinders, an excess of a perfectly pure solution of potash added, and then 3 cub. centims. of a Nessler solution. The standard of comparison is made in the ordinary way, only using acidulated in place of pure water, and neutralizing with potash after adding the standard solution of ammonium salt. Beyond somewhat retarding the point of maximum colouration, a little potassium sulphate does not interfere with the delicacy of Nessler's reaction.

If the experiment has been conducted with proper care, at least four-fifths of the total ammonia ought to be found in the first tube. Four or five litres of air are generally quite sufficient to give a decided reaction, but it is better to use not less than 10 litres, as before mentioned.[1]

Very many experiments have been made by this method, both on air from the town of Burton-on-Trent and that of the adjoining country. The air from the town, as might be expected, varies somewhat in composition; much more so than that taken from the open country, as may be seen from the following tables, in which are given some of the numerous results obtained.

The ammonia is calculated in every case as carbonate ($(NH_4)_2CO_3$); for although nitric acid is sometimes found in air, yet its presence must be looked upon as accidental.

In the immediate vicinity of towns some of the ammonia must also be in the form of sulphate, sulphite, or ammonium chloride.

1. *Air taken from Town.* (Taken at a height of 2 mètres from ground.)

Date of Experiment.	$(NH_4)_2CO_3$ as grammes per 100,000 litres of air at 0° C. and 760 mm. barom.	$(NH_4)_2CO_3$ in parts by weight per 100,000 of air.
1869. September 30	1·1294	·8732
October 4	·62117	·4801
„ 6	·5251	·4059
„ 8	·62117	·4801
November 26	1·0729	·8293
„ 28	1·1000	·8503

2. *Air from Country.* (Taken at a height of 2 mètres.)

Date of Experiment.	$(NH_4)_2CO_3$ as grammes per 100,000 litres of air at 0° C. and 760 mm. barom.	$(NH_4)_2CO_3$ in parts per 100,000 of air.
1869. December 6	·7620	·5890
„ 8	·7826	·6085
„ 9	·6601	·5102
„ 11	·6635	·5121
1870. February 12	·7639	·5904

The direction of the wind does not seem to have any influence on the ammonia found; immediately after heavy rain, however, the quantity falls somewhat below the average, but the air is again restored to its normal condition after a lapse of two or three hours.

Attempts were made to make the method more delicate still by absorbing the ammonia in pure water and then distilling, but the nitrogenous organic matter suspended in the air was found to interfere with the results.

When the air is passed through cotton-wool before entering the absorption-tubes, it is found to be entirely deprived of its ammonia by the filter. This is also the case with air artificially charged with the ammonia *to a large extent*. This absorption is not due to the presence of hygroscopic moisture, since cotton-wool, when absolutely dry, is capable of taking up 115 *times its own bulk* of dry ammonia (confined over mercury) at 10·5° C. and 755·7 millims. barom.; the gas being again slowly evolved when the wool is left in contact with the air at 100° C.

[1] When the air to be examined is highly charged with ammonia, as that from stables, &c., a perfectly dry bottle of 3 or 4 litres capacity should be carefully filled with a pair of bellows, 100 cub. centims. of acidulated water introduced, and, after closing securely, the whole well agitated at intervals for three or four hours. The liquid is then poured out, and the NH_3 estimated by the Nessler solution as usual.

All other porous substances that were tried for filtering agents were found to possess this property more or less; even freshly ignited pumice-stone is not entirely without absorptive effect upon the gas.

The second paper was one of great length, by Dr. H. Davies, on the laws which regulate the areas of the heart's cavities. As this will occupy at least ten of our columns, we are obliged to postpone its publication, and that of Dr. Duncan's paper, read on the 24th, to our next issue.—Ed. S. O.

ETHNOLOGICAL SOCIETY.

March 22nd.—Professor Huxley, F.R.S., president, in the chair. R. S. Newall, Esq., was announced as a new member.

A paper was read "On current British Mythology and Oral Tradition," by J. F. Campbell, Esq., of Islay.—After explaining the sources whence his popular tales of the Western Highlands had been derived, he pointed out the traditional character of myths, and expressed an opinion that genuine British traditions orally preserved in Celtic may probably be old Aryan myths mingled perhaps with pre-Aryan myths. Popular oral history must be founded on a real event; but minor details gradually drop out, while the most conspicuous incidents approach each other. The author showed how a legend sprouts from a fact, which being at first accurately told, passes into a tradition with uncertain dates, and persons and localities. Poetry is a good vehicle for preserving facts, and many current traditions carry with them a rhyme or a proverb to aid the memory. Hence, too, historical events are readily preserved in ballads.

The president, Dr. Archibald Campbell, and Mr. Bouverie Pusey spoke upon this communication.

Dr. Campbell then read a note by the Rev. R. J. Mapleton on a cist with engraved stones on the Poltallock estate, Argyllshire.

ENTOMOLOGICAL SOCIETY OF LONDON.

March 21st.—Mr. H. W. Bates, vice-president, in the chair. Mr. Howard Vaughan exhibited specimens of *Dianthœcia conspersa*, from Devonshire, which, in their colouring, bore a curious resemblance to *D. Barrettii*. Mr. F. Smith exhibited a larva from Monte Viedo, which was profusely covered with bristles, clavate at their tips. Mr. Bond exhibited *Psyche vetulella*, a moth first detected in this country in 1869. Mr. Stainton exhibited *Cosmopteryx Lienigiella*, bred from a reed-feeding larva, found in Wicken Fen, Cambridgeshire.

The following paper was read:—"Notes on the Butterflies described by Linnæus," by Mr. W. F. Kirby.

Part I. of the *Transactions* for 1870 was on the table.

VICTORIA INSTITUTE.

An ordinary meeting was held on Monday evening last at 8, Adelphi-terrace, Rev. W. Mitchell, M.A., vice-president, in the chair. A paper was read "On Geological Proofs of Divine Action," by S. R. Pattison, Esq., F.G.S."—The author sought to establish the proposition that the condition and disposition of the strata disprove the theory of perpetual recurrence or uniformitarianism, and supported by the theory of serial progression. The latter may be styled "evolution," if by this term is only meant the unfolding of phenomena connected by a common plan, but not if it is intended to express that every state contains the causation of its successor. The discussion on the paper was sustained by Mr. Reddie and Mr. Bradlaugh.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

February 28th.—John Watson, Esq., president of the section, in the chair. The following extract from a letter to Mr. H. A. Hurst from Dr. Mueller was read:—

"I should be obliged if you would procure for me seeds (or roots) of Sagittaria, Hottonia, Butomus, Lysimachia, *vulgaris* and *thrysiflora*, Menyanthes, Villarsia, Lychnis, Flos-cuculi, *Caltha palustris*, all of which I should much like to naturalize in a lake of this garden. I will gladly send a good collection of Australian seeds in exchange."

The secretary will be glad to receive seeds of any of the above-named plants which members may be able to collect during the ensuing season.

"On some Shell Deposits at Llandudno," by Mr. Joseph Sidebotham.—The author referred to a paper by Mr. Darbishire, published in the Society's *Memoirs* in 1867, where these deposits are mentioned and considered to be the refuse heaps of former inhabitants. The object of the present paper was to enter more into detail as to the composition of these refuse heaps and to fix a probable date as to their being formed; the deposit specially examined is situated at the foot of the Great Ormes Head, on Conway Bay, and has been partially washed away by the sea, a section of it is best seen from the beach; photographs of

it were exhibited. This deposit consists chiefly of shells of Patella, Purpura, and Littorina, and bones of animals, with pieces of charcoal. Mr. Boyd Dawkins, F.R.S., had identified the bones as belonging to the ancient horned sheep, the Keltic short-horn, the horse, and the dog. Many of the bones were split up, apparently for the purpose of extracting the marrow, and some bore the marks of the teeth of dogs. Some of the bones of the horse had been exposed to the action of fire; the charcoal appeared chiefly to consist of burned stems of *Ulex Europæus*.

No traces of weapons, or implements of stone or metal were met with, but Mr. Darbishire found a single fragment of bright red pottery, apparently of Roman manufacture, and from its shape probably being a portion of a small drinking-cup. The absence of all bones of wild animals, birds, and fish, seemed to indicate a very low state of civilization.

The author then proceeded to show, from historical and legendary evidence, that the place where the shell deposit now exists was within historical times far removed from the shore, and quoted from Mr. Hall's paper before the Liverpool Geological Society, in 1864, as to the supposed ancient coast-line, and submergence of the plain which once existed between the Great Ormes Head and Bangor, which is said to have taken place in the fourth century, when the lands and castle of Helig-ab-Glanawg were destroyed. The author also described Mr. Hall's visit to the supposed ruins of this castle, marked "Llys Helig" on the ordnance map, only to be seen at very low tides, and submitted a diagram, copied from the plan of the walls and tower then taken; he also gave the legend of the destruction of this castle, which is still told by the old Welsh people living near. The author concluded that when the refuse heap of shells and bones was deposited, the coast-line must have been somewhat the same as it is now, as Patella, Purpura, &c., being rock shells, could not have been found on a flat sandy coast; if, therefore, the plain was submerged in the fourth century, these shells must have been deposited subsequently; as besides the absence of rocks, the coast would, before that time, have been too distant to render it likely the inhabitants should bring their food so far from where it was found. The very large size of many of the shells of Patella, would seem to prove that the coast had been some considerable time in its present rocky condition, when the shells were gathered, whereas the absence of all traces of bones and teeth of the hog, which are found in such abundance in later deposits, seems to point to the seventh and eighth century as the probable date of the formation of this shell deposit.

PHYSICAL AND MATHEMATICAL SECTION.[1]

January 4th.—E. W. Binney, F.R.S., F.G.S., president of the section, in the chair. "On the Rainfall of 1869, at Old Trafford, Manchester," by G. V. Vernon, F.R.A.S., F.M.S.—The rainfall of 1869 exceeded the average of the last seventy-six years by 0·043 in., so that the fall was almost exactly the average amount for that period. Rain fell upon 197 days in 1869, or upon nine more days than in 1868.

During the first and last quarters of 1869 the rainfall exceeded the average of the corresponding periods for the last seventy-six years, and during the second and third quarters the rainfall of 1869 was below that average.

As compared with 1868 there was 3·221 inches more rain in 1869.

January, February, April, May, September, November, and December, 1869, had a rainfall in excess of the average, especially February and September, the latter month having nearly double the average rainfall.

The remaining months of 1869 had a deficient rainfall, especially March, June, and July, the latter month not having one-third the average fall.

The months in which rain fell upon the largest number of days were January, February, September, November, and December; September reaching the large number of twenty-six days.

March 1st.—E. W. Binney, F.R.S., F.G.S., president of the section, in the chair. "Results of Rain-gauge and Anemometer Observations made at Eccles, near Manchester, during the year 1869," by Thomas Mackereth, F.R.A.S., F.M.S.—The amounts of rainfall were obtained from two gauges 3 ft. from the ground and 145 ft. above mean sea-level, and one gauge 34 ft. from the ground. One of the lower gauges has a round receiver 10 in. in diameter, the other has a 5 in. square receiver; the edges of both are turned inward. These two gauges stand close to each other, and 75 ft. from any building, and free from every obstruction. The higher gauge has a 5 in. square receiver, like the one near the ground. It is 4 ft. above the ridge of my house, and free from every obstruction.

THE WOOLHOPE NATURALISTS' FIELD CLUB.

The club held its annual meeting at the Green Dragon Hotel, Hereford, on Tuesday, February 22nd, which was very fully attended, James Rankin, Esq., M.A., president, in the chair. The financial statement was read, and ordered to be printed. Worthington G. Smith, Esq., F.L.S., of London, and Mr. With were unanimously elected honorary members. The following places and days were next appointed for the field meetings for the present year:—

The Forest of Deerfold, Tuesday, May 24th; Ross and the Wye (Ladies' day), Tuesday, June 21st; Llangorse Lake, Friday, July 22nd; The Longmynd Hills, Shropshire, Friday, August 18th; and Hereford for the "Fungus Foray," Thursday, October 6th.

A communication was then made that the British Archæological Association intended to hold its congress at Hereford this year, at the end of July or the begining of August, and invited the members of the club to assist in its investigation of the archæological objects of interest in the city and neighbourhood.

The chairman of the Central Committee announced that the publication of the *Flora of the County*, by the Rev. W. H. Purchase, had already commenced, and would, he trusted, be steadily continued until completed. He then exhibited some very beautifully coloured illustrations by Worthington G. Smith, Esq., F.L.S., of rare fungi, discovered last year by the members of the Woolhope Club. The first shown was the *Poliporus annosus*, found last February by W. Adams, Esq., F.G.S., president of the Cardiff Club, in a deep unused gallery, or heading, of the Llondu Colliery, Parkslip, near Cardiff. It has the peculiarity of being phosphorescent, and when abundant, lights up the dark galleries in a peculiar manner.

The next fungus was the *Lentinus lepideus*, a rare fungus, first found by Dr. M'Cullough growing from between the timbers on the underside of a railway-bridge at Abergavenny. It was found also by Elmes Y. Steele, Esq., in another locality at Abergavenny. Dr. Bull found it under the roadway of the Shelwick railway-bridge, near Hereford, and it was afterwards observed in several other places, but always growing precisely in the same situation.

The next figures represented a fine golden-coloured fungus, *Cortinarius* (*Phlegmacium*) *fulgens*, which was found growing under oak-trees at Venwood in September last. It is not quite new to the British flora, though it is not mentioned in Berkeley's work. It has once before been found in England, by Mr. Broome, the celebrated mycologist.

The last sheet, however, represented a fungus quite new to Britain. It was first exhibited by Dr. Bull, at Kensington, in 1868, and was found by him several times last autumn at Dinedor and in Haywood Forest. It is a striking fungus, of a dark brown gingerbread colour, and its name is *Cortinarius* (*Phlegmacium*) *russus*. At the suggestion of Mr. Worthington Smith, and with the kind offer of his assistance, it was unanimously decided that a coloured representation of the new *Cortinarius* should be published in the forthcoming volume of the *Transactions* of the club.

The president then introduced the question of the formation of a museum in connection with the club, and after a long discussion, in which many members joined, the following resolution was passed—"That the Woolhope Naturalists' Field Club deems it expedient that a committee be appointed to inquire into the practicability of establishing a museum;" and the following gentlemen were unanimously appointed to it:—Rev. H. Cooper Key, president, Sir George H. Cornewall, Bart., James Rankin, Esq., Dr. M'Cullough, Arthur Armitage, Esq., the Rev. J. C. Robinson, and James Davies, Esq.

The first paper presented to the meeting was "Meteorological Observations for 1869," by Edwin J. Isbell, Esq. (The tables referred to and the *Register of Flood-water on the Wye*, by John Lloyd, Esq., were laid upon the table.)

An abstract of the "Deep Sea Dredging-Experiments" was given by Dr. M'Cullough; "A List of Birds observed in the parish of Bredwardine," by the Rev. R. Blight, was laid on the table, with a very important addition to fungology, by Worthington G. Smith, Esq., F.L.S., being a "*Clavis Agaricinorum*, or a Key to the Study of the British Agarics." This excellent paper divides the class according to the colour of the spores, and by giving typical forms of Agarics on sheets of corresponding colours, very much simplifies this labour of the student, by enabling him quickly to refer any given Agaric to the species to which it may belong.

"A Note on the Life History of *Abdera bifasciata*," by Dr. Algernon Chapman, of Abergavenny, was then read, and by this time the dinner-hour had arrived.

After dinner the president brought forward the distressed state in which the family of Professor Michael Sars, of Christiania, had been left by his unexpected demise. A plate was handed round the table, and £3. 7s. was collected, which the president undertook to forward.

Three glass bowls from the fish-hatching apparatus of J. F. Symonds, Esq., Broomy-hill, contained the *ova* and young fry of the salmon, the great lake trout, and the common trout. They created great interest, and the circulation through their transparent vessels was afterwards well shown by Mr. With's microscope.

The president then read his retiring address, and, on the proposition of Sir George H. Cornewall, Bart., and Arthur Armitage, Esq., received

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[1] Although one of these meetings took place nearly three months ago, the Report only reached us last week.—Ed. *S. O.*

the thanks of the club for his exertions in its interest as president during the past year, amidst much applause.

An interesting paper "On the Ancient Forest of Deerfold," containing a very curious chapter on the adventures of the Lollards, who took refuge there in 1391, was then read, and brought this meeting to a very satisfactory close.

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY, AND NATURALISTS' FIELD CLUB.

On Wednesday evening, 9th March, a joint meeting of the Natural History and Philosophical Society and Naturalists' Field Club was held in the lecture-room of the Belfast Museum. Professor James Thomson, LL.D., occupied the chair. A paper, from the *Proceedings of the Geological Society of London*, by R. Tate, A.L.S., F.G.S., and J. S. Holden, M.D., F.G.S., on the "Iron Ores associated with the Basalt of the North-East of Ireland," was read by Dr. Holden, Glenarm.—The authors stated that, since 1790, an iron band had been known in the midst of the basalt of the Giants' Causeway; but further discoveries during the past few years had brought to view numerous exposures, which were considered to represent portions of one sheet of iron ore, extending uniformly throughout the basalt, and over a very large area. Everywhere the iron band and associated rocks present identical features, from which the following generalized section may be deduced:—The underlying basalt gradually passes upwards into a variegated lithomarge of about 30 ft. thick, graduating insensibly into a yellow or red ochre or bole, of 5 or 6 ft. thickness, which passes into a dense red ochreous bed of about 2 ft., charged with spheroids of magnetic oxide or peroxide of iron. The spheroids are of average size of peas; they increase in number and size towards the upper part of the band, and not unfrequently constitute that portion of it. The line of junction between the iron band and the overlying, and usually more or less columnar, basalt, is in all cases well defined, and sometimes exhibits decided unconformability. Several theories were discussed to account for the origin of the present condition of these ores, but from field observation and chemical analysis the authors had been led to consider them as elaborated out of the basalt by metamorphic action. The decomposition of felspathic basalts by the combined action of water and acidulated gases, dissolving out certain minerals, resulted in the formation of bole and lithomarge. The bole underlying the pisolitic iron band was once a wet terrestrial surface, on which a subsequent volcanic outflow of basalt, by its heat, pressure, and evolved gases, effected a reduction of the oxides of iron into the more concentrated and aggregated form of pisolite. The ferruginous series with interstratified plant beds at Ballypallady were described, and shown to be quite distinct from the preceding, being of sedimentary origin, and marking the site of an ancient lake, probably of the Miocene age. To the same interval of volcanic rest may be referred the various lignite bands, which are known here and there beneath the upper basalt. The mining of these iron ores has developed a new branch of industry in the north-east of Ireland, and one of growing importance—the abundance of alumina present rendering them of peculiar advantage for admixture with the hæmatitic ores of England. Dr. Holden elucidated the subject with photographs, diagrams, and a series of ore specimens; the latter he presented to the geological department of the museum.

At the conclusion of the paper an animated discussion ensued, in which Messrs. Nelson Boyd, F.G.S., William Gray, Silas Evans, S. A. Stewart, W. H. Patterson, G. T. Glover, and the chairman, took part.

DERRY NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

A meeting of this society was held on Friday evening, 4th inst., in the round room of the Corporation-hall. There was a large attendance not only of the members, but of ladies and gentlemen who take an interest in the objects of the society. The chair was occupied by the president, William Harte, Esq., C.E., F.R.G.S.I., Surveyor of county Donegal. The subjects brought under the notice of the meeting were:—1st. A notice of the meteor which passed over the county of Donegal on the evening of the 27th December last, by the president; 2nd. A notice of the Gold Antiquities of Ireland, illustrated by diagrams and specimens, by Mr. Dugan; 3rd, a description of rare Algæ, found only in the north of Ireland, by Mr. Cowie; and 4th, a description of cinerary urns, found at Grange, county Tyrone, and at Malin and other places in county Donegal, by the president. Mr. Cowie sent his paper, with specimens of the Algæ, but was not himself present, and as the other business was found to occupy almost all the available time, the reading of it was deferred.

The president described the fine meteor which passed over the county of Donegal on the evening of the 27th December last, and which he had himself seen. Its course was across the north of the county, from west to east, and was near the planet Venus when it first appeared. It attained its greatest brightness when nearly over the west shore of Lough Swilly, and was then three times as bright as Venus appeared. It was some twelve or fifteen miles above the earth when it burst, and it then left a long sinuous tail behind which remained visible for some time. The head burst into three pieces, the foremost part of which ran on, still blazing, while the others were incandescent and red,—one piece distinctly giving out three jets of gas apparently from it.

BOSTON (U.S.) SOCIETY OF NATURAL HISTORY.

March 2nd.—Mr. W. H. Brigham exhibited a specimen of the soap plant, or "Amole," of California (*Chlorogalum pomeridianum*, Kunth.).

Mr. Brigham stated that the natives use the bulb as a substitute for soap, in washing clothing. It is cut in two, and the fresh mucilaginous surface rubbed upon the cloth in the same manner as soap, to which it is preferred, as its detersive qualities are not impaired by salt water, or even by the strongly impregnated mineral water found in that region. The hairy fibre which covers the bulb when washed and combed makes an excellent substitute for hair in stuffing mattresses, as its elasticity prevents it from "matting." The plant grows in the same arid sandy soil as the cactus, and is found from Monterey northward, to the valley of the Upper Sacramento, and eastward to the summit of the Sierra Nevada.

Prof. N. S. Shaler gave an account of a visit, undertaken by himself at the direction of the superintendent of the United States Coast Survey, to the phosphate of lime beds situated at the mouth of the Ashley and Cooper Rivers, near Charleston, S.C. These beds, which the speaker estimated cover from three to four hundred square miles, are about 3 ft. in thickness, and lie immediately above an immense deposit of Eocene marl. The phosphate beds are found to be composed almost entirely of nodules formed around some Eocene shell as a nucleus, and give, on analysis, about 60 per cent. of phosphate of lime.

In the beds, mingled with the nodules, are found sharks' teeth and shells of the Eocene period, like those in the marl beneath; they also resemble the fossils of Gay Head, on the island of Martha's Vineyard, Mass., with which Prof. Shaler considered them identical.

In the upper layer of this bed are found bones of the mastodon, bones of extinct horses and sheep, and bits of pottery; these bones are all water-worn, and do not appear to have been contemporaneous with the fossils of the bed proper; but were probably accidentally introduced at a later time, by the agency of water.

As regards the age of the beds, Prof. Shaler did not believe that they were the remains of guano deposits as some have supposed, because he had failed to discover any trace of bird bones, though the conditions must have been favourable to their preservation. He believed this deposit to be the detritus of the marls beneath; that water charged with carbonic acid, acting upon the surface of the marl, had, on account of its greater solubility, removed the carbonate of lime, and left the phosphate to accumulate in the concretionary nodules as found.

The speaker was not prepared to account for the original appearance of the phosphoric acid, but he did not believe that it came from the bones of vertebrated animals, as the quantity was too great, he thought, to be thus accounted for. He suggested that possibly it may have been derived from algæ, some kinds of which we know contain it in appreciable quantities.

The chairman of the meeting, Dr. C. F. Jackson, remarked upon the importance of Prof. Shaler's communication, as throwing light upon the possible origin of those ancient beds of phosphate formed as far back in geologic time as the Potsdam period—as far back, in fact, as we have evidence of life upon the globe.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

Paris, March 21st.—The correspondence of the day was opened by M. Dumas.

One of the first papers read was by M. Jouglet, on maladies contracted by workmen and women in the manufacture of chemical or phosphorus matches. The latter especially have been remarked to produce certain affections of the generative organs, in which the usual remedies which hitherto have obviated the unhealthiness of this manufacture have proved unavailing.

General Morin stated that M. Freycinet remarked in one of his works the amelioration in the health of the workmen employed in a manufactory near Antwerp, occasioned by the use of various sanitary measures. Good ventilation is, above all, to be recommended in manufactories.

Another paper read was by M. Chatin, in which the author, with reference to a recent paper of his on the causes of dehiscence of the anthers, adds that resulting from desiccation.

A letter from M. Ramon de la Sagra drew attention to a Cuban palm-tree, an accompanying drawing of which presented the very rare exception of having nine branches at the top, each crowned with a bunch of leaves.

M. Rosentheil, in a paper on the motor force which produces endosmose, tried to establish a complete resemblance between the phenomena which the solution of a body in liquid on one hand and the diffusion of a volatile substance in a gaseous medium on the other present.

A paper by MM. Champion and Pellet brought forward a new method for the preparation of bromhydric acid, which consists in treating the heated paraffin by bromine in vapour.

A paper by M. Melsens contained some interesting experiments on the vitality of the yeast of beer; the most intense cold does not cause it to lose its vital properties, for having submitted it to a temperature of $-100°$ by means of the protoxide of nitrogen, or a mixture of carbonic acid and ether, it still contains its fermentable property; but a considerable pressure, that of twenty-five atmospheres, destroys it completely.

The announcement of these experiments led M. Boussingault to remark the analogy which they presented with regard to those formerly mentioned by M. Pouillet on the vitality of different seeds of certain vegetables which submitted by him to a temperature of $-100°$, had not lost their generative faculties.

M. Boussingault also mentioned the cooling of wines, sometimes used for improving the wine; this operation is considered analogous to that of heating, and M. Boussingault believes the results obtained as advantageous from one as from the other, notwithstanding M. Melsens' opinion that cold does not destroy the fermentable properties as much as heat.

M. Liouville said, that if the wine in the casks be removed and congealed, it is not astonishing that the part remaining liquid should be stronger, as by that the wine had been deprived of some of its water.

M. Boussingault replied that the amelioration took place even in the wine from which the ice had not been removed.

M. Thenard remarked on this subject that congelation, also practised in Burgundy, is not always advantageous. When the wine is not overloaded with saline principles, it improves by congelation, or even by submitting it to a temperature about zero, but if it is too saline the cooling of it renders it rough and bitter in taste. That the operation may succeed it is requisite that the wine have neither too much alcohol nor too much acid.

M. Dumas read a note on various facts in support of M. E. Decaisne's remarks at the last meeting on the relative value of human and animal vaccine.

On the bureau of the Academy were placed several small pieces of wood carbonized in bisulphide of carbon. These specimens, prepared by M. Sidot, were presented by M. Dumas as a proof of the fact that carbonization in a closed vase has, with certain gases, the effect—1st, of augmenting the density of the carbon; 2ndly, to render it a better conductor of heat and electricity; 3rdly, of giving it a metallic lustre; and 4thly, to render it sonorous.

Another specimen upon the bureau of the Academy was one presented by M. Valenciennes, consisted of a piece of metallic cobalt, obtained by the fusion in a crucible of magnesia placed itself in another plumbago (*plombagine*) crucible. It has the appearance of polished iron, and like it can be planed. M. Valenciennes has also obtained, by combining magnesia with copper in different portions, alloys of metals containing 3, 5, and 10 per cent. of magnesia; the latter is nearly white, and has the appearance of steel. M. Valenciennes has procured alloys of cobalt and copper; it is probable that many of these alloys can be made use of in industry.

M. Aimé Girard has obtained a series of hydrogen compounds from bisulphide of carbon: one of these is disulphomethylene $C_4H_4S_4$.

The question of carbonization of miasmata before their expulsion from the wards of hospitals by ventilation was again brought forward, relative to a communication received from M. Cornil Wœstyn, author of the paper presented at the last meeting. To obviate the objection raised by M. Morin on the ground of expense, the author proposed to filter the air at its expulsion from the wards by means of a plug of cotton wool; the miasmata thus collected could be easily burned if required.

M. Morin remarked that the quantity of air expelled from a single hospital of Paris—that of Lariboisière—is 6,000 cubic mètres per hour; and the volume of air emitted from all the hospitals in twenty-four hours is enormous, so that to heat it, as at first proposed, would be a considerable expense; and he persisted in thinking that the benefit to be derived from the operation would be very slight. M. Morin did not believe that the diffusion of miasmata in the atmosphere could be as dangerous as supposed; and that, even though the purification be carried out, he did not see by what means the reality of the good effects of this scheme could be ascertained.

M. Dumas mentioned an experiment of Faraday's, tending to show how very impure the atmosphere of a ward containing even some hundreds of persons is. Two plates were placed in a ward, one empty, the other full of water. At the end of the day the one which was empty remained the same; the other, which was full, was covered with particles of dirt, and by means of evaporation a black and infected mud was extracted from it, caused by the impurity of the atmosphere in the ward. In the atmosphere even, when apparently calm, are numerous particles, the introduction of which into the lungs is sometimes injurious.

M. Morin considers chemical processes of purification are preferable to physical. He approves of the trial of as many processes as possible, but advises that recourse be had to laboratory experiments as a means of thoroughly understanding before applying them.

M. Bouilaud was of the same opinion as M. Morin as to the very slight danger which arises from the expulsion of the air of hospitals into the atmosphere. As to infection in hospital wards, he considers it necessary that every means should be tried to prevent it. During the small-pox epidemic which is now at Paris, he has had occasion to observe that during the period of desiccation the pustules emitted a fetid odour, causing infection, and against which he had to take the utmost precautions recently.

M. Dumas then read a note by M. Ranlin, containing results of numerous experiments on the vegetation of moulds, especially the *Aspergillus niger*, and on the conditions on which its activity seems to depend. These experiments tend to show that if this plant be placed in water in which are foreign substances, its vegetation becomes suspended. Thus, to completely destroy the development of a mould it suffices to introduce into the water which nourishes it 0·00016 part of nitrate of silver, 0·00006 of corrosive sublimate, 0·008 of chloride of platinum, 0·02 of sulphate of copper.

ROYAL INSTITUTE OF LOMBARDY.

MILAN, FEBRUARY 10TH.—The meeting was opened by Dr. Biffi's paper on the Ancient Reformatories of Milan, and was followed by a paper of Senator Brioschi's, which gave rise to a discussion in which Signori E. E. Bucellati, Maggi, Hajech, and Tamagni took part.

Prof. Bizzozero then read a paper relative to the works of Dr. Manfredi on the structure of the ciliary part of the retina; and Prof. Zoncada read the first part of a work entitled "The Formation of the Latin and the Derivation of the Italian from it."

Signor Cantu referred to the publication of the documents of the Archives of Milan, and presented the assembly, in the name of the author, Fernandino Jaceli, with a paper entitled "A Short Notice relative to Bonaventura Cavalieri."

Prof. Ivo Ciavarini read the conclusion of his memoir on the practical and scientific epicurism of the Romans.

The assembly then passed to other affairs, and Prof. Ascoli gave a report from the commission instituted for the purpose of erecting a monument to the memory of the illustrious Carlo Cattaneo. The report met with the unanimous approval of the assembly.

NOTES AND MEMORANDA.

Abyssinian Gold for Jewellery.—Messrs. Pyke, of Thavies Inn, Holborn, have sent us a specimen of what they call Abyssinian gold, and profess to introduce as a substitute for gold in jewellery. It is certainly a very remarkable metallic preparation, and resembles gold of high quality (16 carat gold) more closely than anything we have yet seen. We propose shortly to have the sample analyzed, with a view to determine its composition and its homogeneity. We may say of it now, however, that it is nearly as heavy as gold, and, if it be an alloy, that it surpasses aluminium bronze in its close resemblance to gold. It is a very curious invention.

Photography in Botany.—To illustrate venation and the nature of the surface of foliage photography may be turned to good account—far more than is now commonly thought of. A correspondent to the *American Naturalist* says he has seen a photograph from a specimen of one of the coriaceous-leaved oaks of the Dutch Indies which was truly wonderful in its rendering.

Testing of Alcohol and Spirits for Amylic Alcohol.—Since the internal use of amylic alcohol, even in small quantities, is very deleterious, the means of rapidly testing for its presence in spirits and alcohol (either for pharmaceutical or scientific use) is, says the *Chemical News*, of importance. The suspected alcohol is poured into a burette, mixed with its own bulk of rectified and pure ether, and also its own bulk of water, and the mixture gently shaken; the ether, on becoming separated from the rest of the fluid, floats to the top, containing in solution the whole of the amylic alcohol which might have been contained in the alcohol or spirits under examination. The ether is removed by a pipette, and on leaving it to spontaneous evaporation, will leave behind the amylic alcohol, readily detected by its offensive smell.

A Doubtful Invention.—We notice in the List of Patents just published in France, that one Mr. Ramel has taken out a patent for "improvements in utilizing the leaves of gum-trees as tobacco." By the words "improvements in utilizing" being introduced it is fair to suppose that the use of gum-tree leaves for smoking is not new in France. Certainly we always considered French tobacco wretched stuff, and if it be that this is owing to the large introduction of gum-tree leaves, any improvement in this line will be welcome, and Mr. Ramel deserves the thanks of the French community. Mr. Ramel need not go to the expense of extending his patent to this country, because Mr. Phillips, the head of the Excise, is a very particular gentleman, and might consider the introduction of gum-tree leaves, even of a patent description, something very closely approaching adulteration.—*Cope's Tobacco Plant.*

Fresh Butchers' Meat from America to Europe.—M. H. Yobes in a paper in *Cosmos*, proposes to have the hold of vessels lined with metal (what kind of metal is not stated); the bottom of the hold is next covered with either clean straw, sawdust, or bran, or any other suitable non-conductor of heat. Upon these, the freshly-killed and cut-up meat is placed, and on the top thereof a layer of ice, and on the top of that, again, straw or any of the other substances just named, and next, again, meat and ice, and so on; and after the hold has been thus filled, it is hermetically closed and suitably protected from the effects of hot weather during the journey from Montevideo to Europe.

The Consumption of Tobacco—In spite, says the *British Medical Journal*, of the loud outcry against smoking, made with so much energy a few years ago, and in spite also of the alarming facts which ophthalmic surgeons have recently offered us, the consumption of tobacco does not decrease. The returns show that during the year just ended the British population consumed tobacco at the rate of 1¼ lb. per head. During the last three years there has been each year a slight increase. The quantity used in 1867 was 41,048,000 lb.; in 1868, 41,280,000 lb.; and in 1869, it had risen to 41,719,000 lb. The increase is probably not greater than increase in population will explain. As regards the deleterious influence of the habit, we should like the attention of those who are investigating it to be directed to the differences in the kind of tobacco used. There appears good reason to believe that some kinds are much more injurious than others, and that the shag—the favourite of the English bar-room, and perhaps of English working men in general—is the very worst.

The Constitution of American Kerosene Oil.—In the *Revue Hebdomadaire de Chimie*, Professor Chandler gives an account of this, which is thus abstracted by the *Chemical News*. The specific gravity of the native petroleums varies from 0·778 to 0·910; and the average composition of crude Pennsylvanian petroleum is, in 100 parts—Gazoline (sp. gr., 0·744), 10 parts; naphtha (sp. gr., 0·752), 10 parts; oils fit for burning and lubrication, 76 parts, varying in sp. gr. from 0·844 to 0·760. The paper further contains a large amount of information concerning the American regulations for the sale and testing of petroleum, and gives a tabulated review of the composition of some specimens of kerosene sold at New York, from which it appears that some kinds contain no less than 90 per cent. of the very volatile oils, while in other instances, again, the quantity of the latter is *nil*.

SCIENTIFIC DIARY.

WEDNESDAY, March 30th.

Society of Arts, 8 p.m. "On Submarine Channel Communication," by Thomas Page, Esq., C.E.
Glasgow Philosophical Society, Sanitary and Social Economy Section, 8 p.m. "On Defects in House Construction," by Mr. R. M. M'Intyre.
Royal College of Physicians, 5 p.m. Croonian Lectures: "On Aneurisms of the Aorta," by Dr. Sibson.
Geological Society, 8 p.m.

THURSDAY, 31st.

Royal Society, 8.30 p.m. "On the Relation between the Sun's Altitude and the Chemical Intensity of Total Daylight in a Cloudless Sky," by Dr. Roscoe, F.R.S., and Dr. Thorpe. "On the Acids contained in Crab Oil," by W. J. Wonfor.
Society of Antiquaries, 8.30 p.m. "On the Crypt of the Chapter-house, Westminster Abbey," by Mr. H. Harrod.
London Institution, 7.30 p.m.
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.
United Service Institution, 3 p.m. "The last Campaign of Hanover," by Capt. Brackenbury.
Chemical Society, 8 p.m. "Combination of Carbonic Acid with Ammonia and Water," by Dr. Divers. "On Deep-sea Water," by Mr. T. Hunter. "On Refraction Equivalents of Aromatic Hydrocarbons," by Dr. Gladstone.

FRIDAY, April 1st.

Royal College of Physicians, 5 p.m. Lumleian Lectures: "On the Diagnosis of the Intra-Thoracic Cancer," by Dr. J. R. Bennet.
Royal Institution, 8 p.m. "On Artificial Alizarine," by Prof. Roscoe.
Western Medical and Surgical Society of London, 8 p.m. "On the Management of Early Infancy," by Dr. Martyn.
Geologists' Association, 8 p.m.
Archæological Institution, 4 p.m.
Perthshire Society of Natural Science, 8.15 p.m. "On the Falconidæ of Perthshire." "On the Molluscs of the Ponds of the District."

SATURDAY, 2nd.

Geological Association, 3 p.m.
Royal Institution, 3 p.m. "On the Sun," by Mr. Lockyer.

SUNDAY, 3rd.

Sunday Lecture Society, St. George's Hall. "On the Progress of Life, as Demonstrated by Fossils," by T. Spencer Cobbold, M.D., F.R.S.

MONDAY, 4th.

Entomological Society, 7 p.m.
Medical Society of London, 8 p.m.
Asiatic Society, 3 p.m.
Victoria Institute, 8 p.m. "On Comparative Psychology," by E. J. Morshead, Esq.
London Institution, 4 p.m.
Royal Institution, 2 p.m. General Monthly Meeting.
Society of Engineers, 7.30 p.m. Discussion on paper "The Friction in the Steam Cylinder." "On the Patent Laws," by Mr. W. Lloyd Wise.

TUESDAY, 5th.

Anthropological Society, 8 p.m. "On Phallic Worship," by Hodder M. Westropp, Esq. "On the Influence of the Phallic Idea in the Religions of Antiquity," by C. Staniland Wake, Esq.
Institution of Civil Engineers, 8 p.m.
Pathological Society, 8 p.m.
Syro-Egyptian Society, 7.30 p.m.
Leeds Philosophical and Literary Society, 7.30 p.m. "On International Decimal Coinage," by William Farr, M.D., F.R.S., D.C.L.
Royal Institution, 3 p.m. "On the Nervous System," by Prof. Rolleston.

WEDNESDAY, 6th.

Society of Arts, 8 p.m.
Pharmaceutical Society, 8 p.m.
Royal Society of Literature, 4.15 p.m.
Obstetrical Society, 8 p.m.

THE FORMATION OF DEW.—"H. H."—Please send us the paper if not too long, and then we can determine as to its insertion. It is impossible to judge from a mere abstract as to whether a paper would or would not be suitable to our columns.

THE NATURAL HISTORY OF THE BEE.—"W. A. M."—We have complied with your request in reference to the announcement. Let the publisher send the work, by all means. We have returned the proof of the illustrations, which are pretty. Are any of them lithographs, or are there any wood engravings that we could use?

MR. CARRINGTON'S OBSERVATORY.—"C."—The letter of our correspondent is not very intelligible. We find it almost impossible to read the handwriting. So far as we can discern, it is to the effect that our statement in last number, that the dome was 25 ft. across, should have been 15 ft. If this is so, we have much pleasure in correcting the misstatement, for which, however, we had the authority to which our correspondent refers.

THE WORK OF THE OBSERVATORIES IN 1869.—Our two correspondents "G. H." and "R. M." are thanked. We have altered the title. We were in doubt at first, but thought that probably the way we put it would have answered the purpose. We were of course aware that the work was that of the council.

THE GREAT BESSEL.—As our correspondent points out this was inadvertently printed Berrel in our last.

BOOK OF NATURE AND MAN.—"C. O. G. N." is thanked. We shall probably accept his proposal. We will write shortly to the publishers.

SUN MEASUREMENT.—"Astro." should know our rule not to reply to correspondents who send neither name nor address. If, however, he will consult Mr. Proctor's little works, published by Hardwicke, he will find, doubtless, what he requires.

ALIZARINE.—"P. B."—Write to Mr. Perkins, Secretary to the Chemica Society.

WEDNESDAY, APRIL 6, 1870.

LADIES IN THE LABORATORY.

THE Shrieking Sisterhood, as the *Saturday Review* somewhat offensively styles that band of *esprits forts* who are now so vigorously laying their grievances before the world, have at last a case against the stronger sex which they think establishes the injustice of men to women. The circumstances of the case are certainly a little peculiar, and deserve attention; for the matter must unquestionably be explained if there is any longer to be peace and goodwill towards men. It seems that the authorities of the University of Edinburgh permitted lady students to become members of the ordinary class of chemistry to which Professor Crum-Brown delivers his lectures. With the wisdom of this proceeding we have nothing to do now, though we can well imagine what the Senate will ultimately think of it. The fact remains that a number of ladies—six, we believe—were permitted to enroll their names as members of the chemistry class. As in the usual course of things, these ladies attended the lectures with considerable regularity, and "went in" at the period of examination, and answered the questions put, with the rest of the candidates for honours. Now, it appears that out of a class of 256, the results of the examination gave places of honour to the first thirteen students, and it is one of the standing rules that those who obtain the first four places are entitled to the Hope Scholarships, two of which, besides other advantages, give the holder the right of free work in the laboratory for two seasons, and two for six months only. It seems that the numbers obtained by the first thirteen students were as follows: 87, 86, 85, 84, 82, 81, 80, 80, 78, 76, 75, 75, 75. The third number is that of a lady student, Miss Mary Edith Pechey (85), and the tenth is that of Miss Sophia Jex Blake (76), two of the six ladies enrolled as students. It is clear, therefore, that, according to all precedent, Miss Pechey is legally entitled to hold and enjoy one of the four Hope Scholarships, and to have a six months' course of laboratory instruction. But here comes the grievance, and we are bound to admit, in the absence of any satisfactory reason to the contrary, that it is a grievance, and one that every lover of fair play is forced to condemn. Professor Crum-Brown, in his decision as to the future Hope Scholarships, has awarded these prizes to Messrs. Wilson, Alston, Young, and M'Queen, who were respectively first, second, fourth, and fifth in the examination, and has thus most ungallantly, not to say unfairly, passed over Miss Pechey, who was really third on the list.

This is a proceeding which, however the requirements of expediency may sanction it, is not, as the facts now stand, to be justified for a moment. If the authorities of the University chose to permit these ladies to take the same rank as the ordinary students; if they did—and the question is perhaps to be answered in the negative—then, in the name of the commonest principle of justice, they are bound to extend to them all those privileges and immunities which, *cæteris paribus*, belong to ordinary students. And hence they should unhesitatingly have allowed to Miss Pechey that distinction which she has so well and creditably earned. We can very well understand that Professor Crum-Brown does not desire to have petticoats in his laboratory. The preliminaries of human "binary combinations" are by the laws north of the Tweed not the difficult matters that they are among us, and we can well comprehend the fascinating dangers which would surround a susceptible professor whose fair pupil was interested in "balance" manipulation. In this aspect we can extend our fullest sympathy to Dr. Crum-Brown; but then right is right, and if these ladies were legally constituted ordinary students of the University of Edinburgh, then all we can say is, that Professor Brown should have relinquished his personal objections to a female practical chemistry class, and should have initiated Miss Pechey into the mysteries of the "retort" and "receiver," and the less attractive but not less useful operation of the "blow-pipe" and the "matrass."

It is, says the proverb, "a long lane that has no turning;" and in cases like that of the dispute between Miss Peechey and the authorities of the University of Edinburgh we shall be surprised if the turning is not one which is favourable to Professor Brown's decision. The intricacies of Scotch law, even if it be only University law, are only too well known, and we are disposed to think it will turn out that the grounds on which Miss Pechey and her fair companions were admitted to the course of lectures were not strictly legal—and it is implied in the fact that the ladies did not attend the lectures at the same hour as the other students. Indeed, we believe this is the solution of the whole difficulty. A decision that ladies should be admitted to the medical lectures was arrived at by one section of the governing body, but it was, if we mistake not, subsequently repealed by those higher in authority, and thus, though the ladies were permitted to go on attending the lectures at a special hour, they strictly were not students in the academical sense of the word. If this view of the affair be the correct one it will be seen that Professor Crum-Brown is absolved from all blame in the matter; but should the lady's view of the question be correct, then, undoubtedly, a grevious wrong will have been inflicted on a most distinguished and deserving student of Science.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

ON Tuesday next (12th) Professor Morris will once more accompany the Geologists' Association in a visit to the British Museum. On this occasion he will give a brief discourse on the subjects of Brachiopoda and Echinodermata. The following lectures will also be delivered:—On Cephalopoda, by Mr. H. Woodward; on Elephants and Mastodons, by Dr. Carter Blake; and on the Stone-borers of the Red Crag Sea, by Mr. Charlesworth, F.G.S. The last excursion was, as we anticipated, a great success, and the projected second visit is its consequence.

THE Secretary of State has authorized Mr. Broughton, the Government Quinologist at Madras, to investigate the properties of the indigenous medicinal plants of India. This is a most interesting and important branch of science—important to the people of India, whether regarded in a sanitary point of view, or as a means for developing the resources of the country,—and we are very glad to see the Madras Government has given it the attention it merits. Mr. Broughton appears to have *carte blanche* given him in all arrangements connected with the observations, and the results are to be embodied in an annual report to the India Office.

SIR SAMUEL BAKER'S expedition is making progress. Sir Roderick Murchison, who is the public geographical medium, has published the following extremely interesting statement in reference to the African explorer:—"By a letter from Sir S. Baker to his daughter, Mrs. Edith Marshall, dated Khartoum, 7th of February, and which, by his direction, I have perused, I learn that he and Lady Baker were on that day about to ascend the Nile to Gondokoro, the whole party being in good health and spirits, and expecting to reach that place about the

3rd of March." It is gratifying to learn that the steamers prepared by Mr. Samuda had safely crossed the Great Desert under the able guidance of Mr. Edwin Higginbottom, and were already on the route to the Albert Nyanza. Sir Samuel further announces that whenever he has any important news to communicate he will send the same direct to Sir Roderick.

A RECENT number of a popular American journal, called *Our Young Folks*, contains an interesting sketch of Professor Agassiz, and a very excellent portrait of this eminent biologist.

HERR JULIUS SCHMIDT has announced that he has completed his projected Lunar map of about 6 ft. in diameter; it is not yet published, but specimens of small portions of it may be seen in *Report of the British Association* for 1865 (Report of the Lunar Committee), and in his work, *Rillen auf dem Monde*. The Baron von Mädler is engaged in preparing a new edition of his large map, to include his Dorpat observations.

IT is at last decided that the proposed universal exhibition at Lyons is to take place next year. The designs for the building are ready, and preliminary measures are just commenced. The exhibition is to be open from the 1st day of May to the end of October.

THE protection of our railway guards and drivers is a point of the utmost importance, not only for charity sake, but from the fact that the more tolerable we render their duties the better these will be performed, and the less loss there will be of life and limb. *A propos* of this, we note a very valuable suggestion in the *Builder*, a journal which, by the way, has long been the pioneer of sanitary reform. The writer says that a sad accident lately occurred on one of our metropolitan railways. A guard looking out from his van met his death: his head was dashed to atoms against a bridge. A good look-out could be constantly kept by having a looking-glass near the door: the guard keeping his eye on the glass would have the range of the line. By night as well a night-glass would be useful. Guards would then sit back to the engine, and see all forward free from biting winds, blinding dust, and dangerous bridges.

PROFESSOR AGASSIZ informs us that the Museum of Comparative Zoology of Cambridge, United States, is prepared to furnish extensive collections of all the rocks and loose deposits found upon and about the keys and reefs of Florida; also complete collections of the corals, in fresh and well preserved specimens, in exchange for recent and fossil corals from other parts of the world.

THE German agriculturists have subscribed a considerable sum of money for the purpose of presenting to Baron von Liebig a testimonial in recognition of his services to practical agriculture. *Applied Science* states that the money thus subscribed has, by desire of Baron von Liebig, been appropriated to the foundation of a medal, to be called the "Liebig Medal," which is to be awarded from time to time to that scientific inquirer who shall have made the most successful application of the science of chemistry to agriculture.

THE Government grants in Chili for scientific objects and superior education amount to £65,000, and include the following:—Observatory, £1,100; Library and Museum, £1,600; Conservatory of Music, £900; Academy of Painting, £700; School of Architecture, £500; Polytechnic School, £6,500; School of Sculpture, £500.

THE University of St. Andrews has conferred the degree of LL.D. on Mr. J. T. Boswell Syme, the editor of Mr. Hardwicke's magnificent edition of the *British Flora*.

A CURIOUS new tube-dwelling Stentor is described and figured in the April number of the *Monthly Microscopical Journal*. In the same number Dr. Carpenter describes the structure of a very peculiar fish ovum.

A VERY remarkable and philosophic article appears in the current number of *Britannia*, under the somewhat startling title of the "Science of Immorality." The writer is evidently a clear and able thinker.

RUMOURS from India assert that it is in contemplation to appoint either a Minister for Agriculture in India, or a Government Secretary in the Agricultural Department. According to the *Gardeners' Chronicle* this official would have rule over all botanists, forest officers, superintendents of cotton and cinchona plantations, and the like. Government agricultural experiments are to be carried out on a large scale. All this looks like progress.

THE *American Horticulturist* has secured the services of Mr. Shirley Hibberd as its English correspondent.

HER MAJESTY'S Commissioners for the Exhibition of 1861 have issued an announcement of their forthcoming series of Annual International Exhibitions of Fine Arts, Industry, and Scientific Inventions. The first of the series will be held in 1871.

SOME time since we mentioned it as likely that the Queen would open the University of London in May. The matter is is now beyond doubt. The day fixed for the ceremony—which must be a short one, on account of her Majesty's health—is the 11th of May. All the sister universities will be represented, and the graduates of the London University will appear in academicals. The Prince and Princess of Wales will accompany the Queen. It is proposed that her Majesty should, on arrival, pass up the staircase and through the principal rooms of the building, in the different portions of which as many persons as possible will be distributed; and lastly, enter the large theatre, where an address will probably be presented.

SCIENCE loveth a paternal government. In France far more is often done to assist scientific men than in this country. Here is a new proof:—By decree of the 19th ult., his Majesty the Emperor of the French has, upon the proposition of the Minister for Agriculture and Commerce, approved of the establishment, under the said Minister, of a superior council of technical education, a permanent committee of thirty-two members to be chosen from among the Legislative Assembly, the higher public instruction (professors of universities), the Imperial Conservatory of Arts and Works, the Committee of Arts and Manufactures, the heads of great industrial establishments, the free public instruction, and the Administration (Préfets, Maires, &c.). A sum of £20,000 has been granted to the Minister aforesaid, for the purpose of encouraging technical education; and the committee just alluded to will have to aid and advise the Minister and other parties in the carrying out of a good and useful technical instruction.

IT has been arranged that Dr. Clark, assistant to the late Dr. Penny, who continued the winter course of lectures on Chemistry after that gentleman's death, shall deliver the summer course; also, pending permanent arrangements consequent upon the proposal of Mr. Young, the President, to endow a chair of technical chemistry.

THE visitation in connection with Queen's College, Galway, to which we alluded last week, was held this day week in Dublin Castle. The "Visitors" met to consider Mr. Melville's memorial. The affair is far from being terminated.

THE twenty-first annual session of the American Medical Association will be held in Washington, D.C., on the 3rd prox. The following committees, among others, are expected to report:—On Cultivation of the Cinchona Tree—Dr. Lemuel J. Deal, Pensylvania, chairman; On the Cryptogamic Origin of Disease, with Special Reference to Recent Microscopic Investigations on that Subject—Dr. Edward Curtis, U.S.A., chairman; On the Doctrine of Force, Physical and Vital—Dr. John Waters, Missouri, chairman; On Variola—Dr. Joseph

Jones, Louisiana, chairman; On the Relative Advantages of Syme's and Pirogoff's Mode of Amputating at the Ankle—Dr. G. A. Otis, U.S.A., chairman; On a National Medical School—Dr. F. G. Smith, Pennsylvania, chairman; On Commissioners to Aid in Trials involving Scientific Testimony—Dr. John Ordronaux, N.Y., chairman.

A NEW and rather singular feature in the sales of last week at Liverpool was the purchase of a hundred bales of jute for shipment to America, for the purpose of being dyed and sold as "ladies' back hair." There were other orders, says the *British Medical Journal*, for the same purpose.

AT a meeting of the City Commissioners of Sewers this week, a motion was carried, referring the subject of the adulteration of tea to the Sanitary Committee, with a view to their bringing it before the Government.

THE Senate of the University of London has selected Professor T. Archer Hirst, F.R.S., of University College, to fill the important post of Assistant Registrar in the University.

M. TARDIEU does not seem to increase in popularity with his pupils. Last week, on his return from Tours, he was so hissed and hooted in the theatre of the Ecole de Médecine as to be unable to deliver his lecture. An hour before the professor made his appearance the hall was crammed to overflowing, students from the Ecole de Droit, the Ecole des Beaux-Arts, and the Ecole des Mines having come in great numbers to reinforce their medical comrades. The moment Dr. Tardieu stepped into the rostrum he was assailed by cries of "Go to the Senate," and "Resign, Resign"—sung to the air of the "Lampions." Finding the uproar persistent he did not stay more than five minutes. Before withdrawing he looked disdainfully at the rioters, and said—"Gentlemen, you may prevent me from delivering my lecture, but you will never make me resign my professorship." As soon as he had been seen into his carriage, a medical student, making a tribune of the pedestal of Bichat's statue in the courtyard, harangued the crowd for some time, and ultimately moved that on Monday means should be taken to prevent the entrance to the theatre of any strangers to the profession, so that the medical students alone might decide whether Dr. Tardieu should continue to be heard or not. This motion, after a long open-air discussion, was carried almost *nem. con.*—some law students only claiming, in the name of universal fraternity, the right to join in a row wherever it may take place. Dr. Tardieu is unpopular with the junior students, not only on account of the evidence he gave at Tours about the ecchymosis on Prince Pierre's cheek, but also because it was upon his certificate that an advocate named Sandon, who had annoyed M. Billault, was locked up in a lunatic asylum some years ago. The day after M. Billault's death M. Sandon was set at large, and therefore the students drew the inference that he was only insane *quâ* M. Billault. Dr. Tardieu was therefore accused of having given a complaisant certificate.

A CONTEMPORARY states that the Imperial Academy of Science, Lille, has offered two prizes—one for the best work on some branch of experimental physics; the other on the use of the thermometer in medicine. The prizes will consist of 1,000 francs each.

THE Geological Collection in the Prague Museum has, says the *Geological Magazine*, much increased of late, owing to the vigorous labours in the field by the Committee of Exploration. Of chalk fossils the Museum contains more than 6,000 specimens, from 140 localities. Dr. Fritsch hopes some English geologists will visit and examine the collection. A new entire Scorpion has been discovered in the coal-measures at Prahys, and a new Saurian in the Permian rocks near Pilsen, which Dr. Fritsch hopes shortly to figure and describe.

PROFESSOR GIUSEPPE GIANNUZZI, of the University of Sienna, Dr. Giovanni Demarchi, formerly at the head of the Section of Public Health at the Home Office of Italy, and Dr. Villavecchia, of Solero, a veteran practitioner, have been nominated Knights or Officers of the Crown of Italy.

THE Society of Arts' conversazione is fixed to take place at the South Kensington Museum on Wednesday evening, the 4th of May.

THE professors of the University of Vienna have, according to the foreign correspondent of the *Lancet*, lately met for the purpose of deciding whether the degree of Doctor of Medicine may be conferred upon women. As yet no lady has presented herself as a candidate in Vienna, but as the case may occur, it was considered necessary to make some provision beforehand. The professors resolved, meanwhile, that all ladies holding foreign diplomas would be admitted to attend lectures and visit the hospitals. Two ladies, one a Swiss and the other English, have already availed themselves of the opportunity.

AN act of apparent injustice has been committed on the part of the authorities of the University of Edinburgh toward one of their lady pupils. It appears, according to the statements published, that one of the members of the chemistry class, Miss Mary Edith Pechey, obtained fourth place among the thirteen who were classed for honours, and according to this was entitled to one of the Hope scholarships. Dr. Crum-Brown, however, has passed her over, and awarded the scholarship to a gentleman who stood below the number of marks. There has been considerable outcry against the decision.

THE *Athenæum* has been trying, in a rather discreditable fashion, to deprive Mr. Proctor of the merit of having constructed the globe of Mars from which Mr. Browning's stereograms were taken. Mr. Proctor's letter in Saturday's issue is, however, sufficiently explicit, and places the matter in its proper light. It is to be regretted that a journal of so high a repute as the *Athenæum* at one time possessed should allow the petty jealousies of the wire-pullers of the scientific world to display themselves in its pages.

MR. FRANK BUCKLAND, M.R.C.S., has just presented to the museum of the Royal College of Surgeons an enormous pike (*Esox lucius*, Linn.), which weighed 32 lb., and was 3 ft. 8 in. long. It was caught by fair angling in one of the broads of Norfolk. This being the spawning season, it was about to deposit its eggs, which weighed 5 lb., and numbered about 595,200. Yarrel states that pike have been caught in the Norfolk Broads weighing from 28 lb. to 34 lb. Rapid growth requires to be sustained by a corresponding proportion of food, and the pike has always been remarkable for extraordinary voracity. Eight of these fish, weighing about 5 lb. each, consumed nearly 800 gudgeons in three weeks, and the appetite of one of these fish, says Mr. Jesse, was almost insatiable. One morning he threw, one after another, five roach, each about 4 in. in length; the pike swallowed four of them, and kept the fifth in his mouth for about a quarter of an hour, when it also disappeared. Mr. Buckland made a mould of this fine fish for his museum.

ON Thursday last Mr. Francis Ronalds received the order of Knighthood from her Majesty in consideration of his having been the original inventor of the electric telegraph.

ACCORDING to the *Mémorial Diplomatique*, the Austrian Government has just signified its assent to a proposal of the French Government for an International Commission to assemble in Paris in order to agree upon a common standard of measurement for all civilized nations. Already fifteen European Powers have announced their willingness to take part in the Commission. Even England, which hitherto has been disinclined to depart from old customs, will be represented by the Directors of the Observatories of Greenwich and Oxford. The French Government now only awaits replies from the United States, Brazil, and the South American Republics previous to calling together the Commission. The Minister for Foreign

Affairs would of right be the honorary president, but the proceedings will really be directed by the vice-president, General Morin, Director of the Conservatoire des Arts et Métiers, in whose archives is deposited the official standard of the mètre recognized in France.

The new Professorship of Physical Science is at last about to be established at Cambridge. The Syndicate appointed for the purpose had to give up the notion of raising the funds by subscription from the several colleges. They confined their attention, therefore, to the means of raising sufficient funds only for carrying out the recommendations of the Physical Science Syndicate in their report dated Feb. 27, 1869. These were to provide the stipends of a Professor of Experimental Physics, of a Demonstrator, and an attendant, requiring altogether a sum of £660 per annum; also to provide a capital sum of £5,000 for a new building, and £1,300 for apparatus. The Syndicate are of opinion that these sums may be raised from the ordinary sources of revenue of the University, and that a small addition (viz., 2s. a head) to the amount of the annual capitation tax will suffice for the purpose. They think, also, that there are circumstances connected with the fixing the amount of the capitation tax by the grace of May 31, 1866, which in themselves justify some increase, and they mention the increased payments of late required for the town improvements. They think that the buildings may be erected from the existing building funds, and apparatus purchased by money belonging to the chest, and now invested.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

ORIGIN OF GOLD NUGGETS AND GOLD DUST.

BY ANDREW MURRAY, F.L.S.

THE origin of gold nuggets and gold dust is not so simple or clear as at first sight it appears to be. The natural explanation of the production of gold dust is that it is the golden portion of the *débris* of rocks which have originally had gold disseminated through them. As the wear and tear of ages has crumbled into dust mountains so composed, part of the dust becomes sand or quartz, or whatever else the basis of the rock may be, and the other part is the liberated gold from which the quartz has been rubbed away; and if we accept this as the explanation of the production of gold dust, the same hypothesis should explain that of gold nuggets which are found associated with it.

But there are various circumstances which it is difficult to reconcile with this theory. One of these is the occurrence in the drift of nuggets of a larger size and less intermixed with foreign substances than have yet been discovered in any quartz reef; as most people are aware, the gold in reefs is usually disseminated in particles and strings through the quartz veins or rock, instead of lying in pockets or masses. Another still more remarkable fact, applicable both to gold dust and gold nuggets, is that alluvial gold is generally of a higher standard than that obtained from the reefs. It is needless to say that if it is merely the gold washed or crumbled out of these reefs it ought to be of identically the same standard and quality. Another objection to the dust being merely the degraded particles released from the rock is the size of the particles—not nuggets, but particles of dust. Gold being so much softer than quartz, its particles after being subjected to the same degree of attrition ought to be vastly smaller; although of greater toughness than quartz, and possessed of ductility and tenacity which quartz wholly wants, it is very soft, and under the influence of the attrition from running water and its accompaniments ought to be pounded and torn into the minutest fragments; but this is not so. There is, moreover, a marked difference in the appearance of the gold dust from different drifts in different countries. In some it is like dust or sand, in others it is like scales. If subjected to the same influences in all, there seems no reason why the same shape should not obtain in all.

These peculiarities would suggest that some other influence than mere degradation of gold-charged rocks has been the agent in producing gold dust; but in any and every view we think it cannot be disputed that degradation must have had some share in the work. It is plain that if a gold-charged rock is reduced to gravel, sand, or powder, particles of gold of some size or other, or gold in some shape or other, must form part of the *débris*. These gold remnants should be found in greater quantity and in greater size the nearer they lie to the source from which they were drawn; and this we believe also to be the case. The general similarity between gold-producing districts, by which a Californian miner could detect a likely spot for gold in Australia or Kildonan, probably depends rather on the character of the mountains out of which the gold has come than on the mode of production of the manufactured dust, if we may call it so. We imagine that the truth will be found to be that the result is referable to two causes, only one of which may in some cases have been present, at others both;—the first, the ordinary process of degradation and grinding the rock to fragments; the other, as suggested by Mr. Selwyn, the Government geologist of Victoria, that gold has also been taken up in solution by the water permeating the gold-bearing rocks, and that in passing through the drift, in which minute particles of gold lay, it has from some cause become decomposed, and the gold held in solution been precipitated and deposited around the most congenial nuclei presented to it, which would undoubtedly generally be the particles or pieces of reef gold, or any other metallic substances for which it had an affinity.

We find an interesting paper on this subject in the *Transactions of the Royal Society of Victoria* (1867), by Mr. C. Wilkinson, in which he mentions some facts bearing on the subject. It appears that Mr. Daintree, formerly of the Geological Survey of Victoria, had on one occasion prepared for photographic uses a solution of chloride of gold, leaving in it a small piece of metallic gold undissolved. Accidentally, some extraneous substance, supposed to be a piece of cork, had fallen into the solution, decomposing it and causing the gold to precipitate, which made a deposit in the metallic state, as in the electro-plating process, around the small piece of undissolved gold, increasing it in size to two or three times its original dimensions. Considering this accidental experiment of Mr. Daintree's as in some measure supporting Mr. Selwyn's theory, Mr. Wilkinson followed it up by a few simple experiments in the same direction, which he details in his paper. In his experiments a small chip of wood was generally used as the decomposing agent. In one instance he used a bit of leather. All through the wood and leather gold was disseminated in fine particles, and when cut through the characteristic metallic lustre was highly reflected. From various experiments it would appear that organic matter is the necessary chemical agent for decomposing a solution of the chloride of gold in order to precipitate the gold as a coherent coating around a nucleus; and that, so far as Mr. Wilkinson had yet tried, iron, copper, and arsenical pyrites, galena, antimony, molybdenite, blend, wolfram, and metallic gold constitute essentially favourable nuclei to determine this chemical reaction. It is to be observed, too, that organic substances, such as fragments of wood, roots of trees, &c., occur abundantly in the gold drifts of Australia. If water holding gold in solution circulates through the rocks and drifts all the conditions necessary for the production of gold dust and nuggets by deposit are present. Does the water so circulating now hold gold in solution? One would think it would not be difficult for a chemist in Australia or California to determine the fact by direct experiment, but it does not appear that it has ever been tried. Mr. C. Wilkinson, however, quotes

facts which lend probability to the view that when the trial is made, the question will be solved in the affirmative. In testing a solid mass of iron pyrites, Mr. Daintree found gold throughout. This mass retained the structure of a tree-stem, in which the organic structure was replaced by pyrites. It had been taken from the Ballarat drift, and the same experiment was repeated by Mr. Newbury, the Geological Survey analyst, on another stem taken from the same drift, with a like result. Gold in such deposits assumes a mammillary form, which appears analogous to that presented by the surface of nuggets—a point of some importance, for, in the first place, it is a question whether a mammillary surface is the kind of surface that would be produced by abrasion and attrition; and, in the next place, abrasion or attrition can certainly have nothing to do with its appearance in these golden petrifactions. We cannot avoid attaching the greatest importance in relation to the question, to the presence of gold in pyrites that has been formed in wood imbedded in auriferous drifts. The gold *must* have been in solution when so deposited, and everything will then depend on the age of the so petrified wood. If contemporaneous with the drift the question is answered. Another fact to the same effect is, that sometimes gold incloses a nucleus of brown iron, &c. This is obviously quite inconsistent with such pieces of gold having been abraded, as they are out of crumbling rocks; such nucleated pieces of gold are never found in reefs. It is the old puzzle of a reel in a bottle.

In relation to this we may remark that we believe that nuggets have never been found in the gold-fields of Brazil. We have the authority of Mr. Harding (a gentleman well known for his great practical knowledge of gold-mines and mining in that country) that he never met with nor heard of a nugget properly so called in all his many years' experience in the gold district of Brazil; but, on the other hand, it is there almost invariably found in veins in connection with, or in the vicinity of, some other metal—generally iron. In what is probably the most prolific mine of gold that has ever been known in the whole world, that of San Juan del Rey (the value of which was not very long since so seriously depreciated by the accidental destruction by fire of the wooden ladders, supports, and machinery), the gold is found in a matrix of porous iron or agglutinated iron sand called Jacotinga, which consists of a bed or vein, not a foot in width, but so incredibly rich that on one occasion when our informant was on a visit to the manager, there was brought in on an assiette, as a sort of dessert for the eyes after dinner, a lump of gold, ore that had been extracted that day from the mine. It was about the size of a large fowl, not so big as a turkey, but bigger than a duck. It was a mass of Jacotinga-iron with gold all mingled and streaked through it. The gold when afterwards extracted was found to amount to 30 lb. weight. On the previous day the amount of gold obtained from the Jacotinga had been 67 lb., and on the day following 130 lb., equal in value to about £8,000. We only mention it as a corroborative instance of the concurrent presence of gold and iron. Lastly, as pointed out by Mr. Wilkinson, it must be admitted that the fact that gold may be greatly purified by dissolving and reprecipitating it, is very suggestive of the generally higher standard of alluvial over reef gold being due to a similar cause.

New Method of Extracting Gelatine, &c.—It is announced that a mode of obtaining gelatine from all animal substances capable of yielding glue has been discovered. The oils and grease are separated from the gelatine by means of benzine, coal-oil, or other hydrocarbons. In some cases it is found advantageous to treat the material with lime before the hydrocarbons are employed; but these are only exceptional. After the substances treated have lain for a considerable time in benzine, or other agent employed, the fatty matters are dissolved, and the pure gelatine is found at the bottom of the vessel; they are, therefore, easily separated in order to be treated in the usual manner. The hydrocarbons are recovered by evaporation, by means of steam and condensation, and both the gelatine and the fatty matters are afterwards purified by the ordinary processes.

THE TOWER SUBWAY.

THE subway consists of a narrow tunnel uniting two vertical shafts, one of which is on Tower-hill and the other in Vine-street, Tooley-street. The tunnel is lined with iron tubing, bolted together in short lengths by means of flanges projecting on the internal surface. The placing and fixing of the portions of the tube were effected within a shield or bell, which was constantly pushed on before the advancing work; and the conception has been seized upon by Mr. Bateman as the basis of his well-known suggestion for a submarine tube to carry a railway from England to France. The Thames tube is 7 ft. in clear internal diameter, or 6 ft. 8in. between the flanges, and it carries a railway of 2 ft. 6 in. gauge. On this railway runs an omnibus capable of conveying twelve passengers. The tube is about a quarter of a mile in length, and sinks from both ends towards the centre with a gradient of about 1 in 30. The omnibus is of iron—light, but very strong, and runs upon eight wheels. It is connected with a rope of steel wire by means of a gripe that can be tightened or relaxed at pleasure, and at each end of the tunnel this wire runs over a drum worked by a stationary engine. The declivity of the tunnel is such that, when once the omnibus is started, it requires only a small amount of traction, and the momentum acquired during its descent will carry it a long way up the opposite slope. It is said that the strain on the rope will never exceed 2 cwt., and the rope used, although very slender in appearance, is capable of bearing more than a ton. The omnibus is provided with breaks, so that its motion is completely under the control of the man in charge; and at each end of the tunnel it is received by buffers, or rather catches, that are connected with very strong springs of vulcanized india-rubber. The shafts at each end of the tunnel are 60 ft. in depth, and are lined partly with brickwork and partly with iron tubing. Within these shafts there are lifts, capable of carrying six passengers at once, and these lifts are raised and lowered by the same engines that work the drums. Each lift has a counterpoise equal to its own weight and to that of three average passengers; so that the weight of three passengers represents the *maximum* of work that will be demanded from the engine, either for raising or lowering. At the top of each lift is a very ingenious contrivance by which a breakage of the suspending chain would close iron claws, upon the lateral guiding rails, and would bring the machine to a standstill in the course of a few feet. At collieries, where the miners are raised and lowered in a cage, it sometimes happens that they are carried over the wheel at the top; but the ascent of these lifts is checked by springs of steel and india-rubber, which the engine employed would not be strong enough to break. The wheel over which the suspending chain runs is also dragged, so to speak, by revolving fans, and too great rapidity of either ascent or descent seems to be rendered practically impossible.

The arrangements visible from the world above are almost ostentatious in their simplicity. The upper opening of each shaft is covered by a tiny square building, like a slightly exaggerated sentry-box. At the door will stand an official, provided with a book of tickets and a pouch for money. As they pay passengers will enter the box and descend in the lift. On reaching the bottom they find a space of a few feet between the shaft and the buffers fitted up with benches as a waiting-room. When the omnibus arrives and has disgorged its load, those who are waiting will step in, and will start off immediately for the other end. The descent of the shaft occupies 25 seconds, and the omnibus journey 70 seconds, so that a passenger may sink into the earth at Tower-hill and emerge in Vine-street in a minute and three-quarters from the time of his disappearance. Allowing for all ordinary causes of detention, such as missing the lift at the moment of its descent, or being just too late for the omnibus, the journey from point to point cannot occupy more than five minutes. The lifts, as they only carry half as many passengers as the omnibus, will make twice

as many journeys, and it is intended to give priority of ascent to first-class passengers, who will pay 2d. for that privilege. Second-class passengers will pay 1d.

The most extraordinary part of the whole undertaking has been its cheapness. The capital of the company amounts only to £18,000; and the plant would provide for a traffic which would repay this capital in a single year. As in the little sentry-boxes, so below, the cheapness is almost painfully evident. There is an intrusive absence of decoration. The waiting-place is whitewashed, and the benches are painted drab. The omnibus is lined with American cloth, and coloured of a dirty green overhead. The French gentleman who loved to travel by the Metropolitan Railway on account of the beautiful pictures with which the carriages and stations are decorated, would find the Subway barren. We trust the directors will obtain some life and colour for the walls. We trust that they will also introduce gaslight instead of paraffin lamps, which are liable to be blown out by the rush of air that precedes the carriage, and which even when they aid the sight, are apt to offend at least one other sense.—*Times*.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From March 27th to April 2nd, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Black Bear (Ursus americanus) ♂	North America	Presented by Col. Jenyns and Officers of the 13th Hussars.	Carnivora-dens
1 Puffin (Fratercula arctica)	British Coasts	Received in Exchange	Fish-house
2 Pairs of Love-bird Parrakeets (Agapornis pullaria)	West Africa	Purchased	Parrot-house
1 King Parrakeet (Aprosmictus scapulatus) ♂	New South Wales	Presented by John Biffen, Esq.	Ditto
2 Hybrid Ibex (between Capra megaceros ♂ and C. ibex ♀)		Born in the Menagerie	Markhoor-house
1 Northern Lynx (Felis borealis) ♂	North America	Purchased	Small Mammal House
1 Smew (Mergus albellus) ♂	British Islands	Ditto	Fish-house
2 Pintails (Dafila acuta) ♂	Europe	Ditto	Three Island Pond

♂ Male. ♀ Female.

ON THE TEMPERATURE AND ANIMAL LIFE OF THE DEEP SEA.

BY WILLIAM B. CARPENTER, M.D., F.R.S.

In Four Parts.—Part III.

THE general results of the dredging operations carried on during the *Porcupine* expedition will now be concisely stated.

In the first place they show conclusively that there is *no limit to the depth at which animal life may exist on the ocean-bed;* and that the types found at even the greatest depths may be *not less elevated in character* than those inhabiting shallower waters. It would even be premature yet to affirm that the higher types occur in less abundance and variety than at more moderate depths; for it is by no means impossible that the use of the improved method of collection devised by Capt. Calver,[1] which was employed with extraordinary success in the *third* cruise, may make as large an addition to our knowledge of the life of the sea-bottom explored by the dredge in the *first* and *second* cruises of the *Porcupine*, as it has done in the case of the cold area, where it revealed the astonishing richness of the bottom, which the *Lightning* dredgings of the previous year had led us to regard as comparatively barren.

Secondly, they confirm our previous conclusion that *temperature* exerts a much greater influence than pressure on the distribution of animal life. Not only have we found the same forms presenting themselves through an enormous *vertical* range—no amount of fluid pressure being incompatible with their existence—but we have also, by a more complete survey of the relations of the warm and cold areas, established the very marked difference between the Faunæ of two contiguous portions of the sea-bed lying at the same depth, which was indicated by the *Lightning* dredgings. It is remarkable, however, that this difference showed itself more in the Crustaceans, Echinoderms, Sponges, and Foraminifera, than it did in the Mollusca, of which a considerable proportion were common to both areas. The abundance and variety of animal life on a bottom of which the temperature is a least 2° (Fahr.) below the freezing-point of fresh water, is a fact which has all the interest of surprise; and it is scarcely less remarkable that the forms of Mollusks, Echinoderms, and Sponges, which seem to be the characteristic inhabitants of this cold area, should attain a very considerable size. The precise limitation of the Globigerina mud and of the Vitreous Sponges to the warm area, was a very striking manifestation of the influence of temperature, and has very important geological bearing.

Thirdly, they have largely added to the number of cases in which types that had been regarded as characteristic of earlier geological periods, and to have long since become extinct, prove to be still existing in the depths of the ocean; and greatly increase the probability that an extension of the like method of research to more distant localities would produce even more remarkable revelations of this character.

The doctrine propounded by Professor Wyville Thomson, in the Report of the *Lightning* expedition, as to the absolute continuity of the Cretaceous formation with the deposit of Globigerina mud at present in progress on the North Atlantic sea-bed, has received such striking confirmation from the discovery of the persistence of numerous Cretaceous types, not merely in our own explorations, but also in those carried on by the United States Survey in the Gulf of Mexico, that it may be fairly affirmed that the *onus probandi* rests upon those who assert that the formation of true Chalk has ever been interrupted since the Cretaceous period. That period is usually considered to have terminated with the elevation of the Cretaceous deposits of the European area into dry land. But according to the accepted doctrines of geology, it is highly probable that, coincidently with the elevation of the European area, there was a gradual subsidence of what is now the Atlantic sea-bed; so that the Globigerinæ of the former area, with many accompanying types of animal life, would progressively spread themselves over the latter, as its conditions became favourable to their existence. And there seems no reason why they should not have maintained themselves in its deepest parts, through the comparatively small changes of level which took place in this portion of the earth's crust during the Tertiary epoch.

[1] This consists in the attachment of "hempen tangles" to the dredging apparatus, by which the floor of the ocean is *swept* as well as *scraped*. These tangles often came up loaded, when the dredge was nearly empty.

Fourthly, the *Porcupine* explorations have enormously extended our knowledge of the British Marine Fauna; alike by the discovery of new types, and by the addition of types previously known only as inhabitants of other localities. The Mollusca alone have as yet been fully examined; and Mr. J. Gwyn Jeffreys, whose authority upon this part of the subject is not second to that of any other naturalist, reports as follows:—The total number of *species* of Marine Mollusca enumerated in his recently completed *British Conchology* (excluding the Nudibranchs) is 451; and to these the *Porcupine* expedition has added no fewer than 117, or more than *one-fourth*. Of these as many as fifty-six are undescribed, whilst seven were supposed to be extinct as tertiary fossils. Sixteen *genera*, including five which are undescribed, are new to the British seas. "All that I could do," he says, "by continual dredgings in comparatively shallow water during the last sixteen years was to add about eighty species to the number described by Forbes and Hanley. I regard the present (although a large) addition as merely an earnest of future discoveries. In fact the treasury of the deep is inexhaustible." The complete examination of the Crustacea, which are in the hands of the Rev. A. M. Norman, and of the Annelids which have been undertaken by M. Claparède and Dr. Macintosh, will probably yield results scarcely less striking. It is, however, in the Echinoderms and Sponges, which are being examined by Professor Wyville Thomson; in the Stony Corals, which have been referred to Dr. P. M. Duncan; and in the Foraminifera, which constitute the author's own speciality, that the most interesting novelties present themselves.

An enormous addition has been made to the list of British Echinodermata by the discovery in our own seas of a number of species which had been previously known only as Norwegian or Arctic; and these often occurred in extraordinary abundance. One of the most interesting of these was the large and beautiful Feather-star, the *Antedon* (*Comatula*) *Eschrichtii*, hitherto known only as inhabiting the shores of Greenland and Iceland, but now found over all parts of our cold area. On the other hand, the influence of temperature was marked not only by the absence of many of the characteristically southern types of this group, but by the *dwarfing* of others to such an extent that the dwarfed specimens might be regarded as specifically distinct, if it were not for their precise conformity in structure to those of the ordinary type. Thus the *Solaster papposa* was reduced from a diameter of *six* inches to *two*, and had never more than ten rays, instead of from twelve to fifteen; and *Asterocanthion violaceus* and *Cribella oculata* were reduced in like proportion. But, in addition, several Echinoderms have been obtained which are altogether new to science, most of them of very considerable interest. The discovery at the depth of 2,435 fathoms, of a living Crinoid of the Apiocrinite type, closely allied to the little Rhizocrinus (the discovery of which by the Norwegian naturalists was the starting-point of our own deep-sea explorations), but generically differing from it, cannot but be accounted a phenomenon of the greatest interest alike to the zoologist and the palæontologist. Another remarkable representative of a type supposed to have become extinct, occurred at depths of 440 and 550 fathoms in the warm area, being a large Echinidan of the Diadema kind, the "test" of which is composed of plates separated from one another by membrane, instead of being connected by suture, so as to resemble an armour of flexible chain-mail, instead of the inflexible cuirass with which the ordinary Echinida are invested. This type bears a strong resemblance to the very singular fossil from the white chalk, described by the late Dr. S. P. Woodward, under the name of *Echinothuria floris*. Specimens were also obtained, both in the first and third cruises, of a most interesting Clypeastroid, which is closely allied to the Infulaster—specially characteristic of the later chalk.[2] These constitute only a sample of the interesting novelties belonging to this group, which our explorations brought to light.

Besides further additions to the remarkable group of Vitreous Sponges, which were made in the area over which the Globigerina mud extends, a peculiar and novel form of Sponge was found to be one of the most generally diffused inhabitants of the cold area. This sponge is distinguished by the possession of a firm branching axis, of a pale sea-green colour, rising from a spreading root, and extending itself like a shrub or a large branching Gorgonia. The axis is loaded with siliceous spicules, and spicules of the same form are contained in the soft flesh which clothes it.

The Foraminifera collected in the *Porcupine* expedition present features of no less interest, though their scale is so much smaller. The enormous mass of Globigerina mud (sometimes almost pure, sometimes mixed with sand) that everywhere covers the deep-sea bottom in the region explored, save where its temperature is reduced nearly to the freezing-point, may be judged of from the fact that in one instance the dredge brought up *half a ton* of it from a depth of 767 fathoms. The resemblance of this deposit to chalk is greatly strengthened by the recognition of several characteristically Cretaceous types among the Foraminifera scattered through the mass of Globigerinæ of which it is principally composed; as also of the Xanthidia, frequently preserved in flints. Not many absolute novelties presented themselves among the Foraminifera that form true calcareous *shells;* the chief point of interest being the occurrence of certain types of high organization at great depths, and their attainment of a size that is only paralleled in much warmer latitudes, or in the Tertiary or yet older formations. This is especially the case with the Cristellarian group, which has a long geological range, and also with the Milioline, of which specimens of unprecedented size presented themselves. The most interesting novelty was a beautiful Orbitolite, which, when complete, must have had the diameter of a sixpence, but which, from its extreme tenuity, always broke in the process of collection. Of Arenaceous Foraminifera, however, which construct *tests* by cementing together sand-grains, instead of producing shells, the number of new types is such as seriously to task our power of inventing appropriate generic names. Many of these types have a remarkable resemblance to forms previously known in the chalk, the nature of which had not been recognized. Some of them throw an important light on the structure of two gigantic arenaceous types from the Upper Greensand, recently described by the speaker and Mr. H. B. Brady, an account of which will appear in the forthcoming part of the *Philosophical Transactions;* and there is one which can be certainly identified with a form lately discovered by Mr. H. B. Brady in a clay-bed of the Carboniferous Limestone.

The question now arises whether—as there must have been deep seas in all geological periods, and as the changes which modified the climate and depth of the sea-bottom were for the most part very gradual—we may not carry back the continuity of the accumulation of Globigerina mud on some part or other of the ocean-bed into geological epochs still more remote; and whether it has not had the same large share in the production of the earlier calcareous deposits, that it has undoubtedly had in that of the later. The foraminiferal origin of certain beds of the Carboniferous Limestone, for example, appears to be indicated by the presence of Globigerinæ, long since observed by Professor Phillips in sections of them, as well as by the fact just stated. The sub-crystalline character of these rocks cannot be regarded as in any way antagonistic to such an idea of their origin, since it is perfectly well known that all traces of the organic origin of calcareous rocks may be completely removed by subsequent metamorphism—as in the chalk of the Antrim coast.

What is the *source of nutriment* for the vast mass of animal life covering the abyssal sea-bed, is a question of the greatest biological interest. That animals have no power of themselves

[2] This was believed at the time to be an entirely new discovery; but since the return of the *Porcupine* we have learned that a type generically, if not specifically, the same, had been obtained by Count Pourtales during his most recent dredgings in the Gulf of Mexico, and had been described by Mr. Alex. Agassis under the name *Pourtalesia miranda*.

generating the organic compounds which serve as the materials of their bodies—and that the production of these materials from the carbonic acid, water, and ammonia of the inorganic world, under the influence of light, is the special attribute of vegetation—is a doctrine so generally accepted, that to call it in question would be esteemed a physiological heresy. There is no difficulty in accounting for the alimentation of the higher animal types, with such an unlimited supply of food as is afforded by the Globigerinæ and the Sponges in the midst of which they live, and on which many of them are known to feed. Given the Protozoa, everything else is explicable. But the question returns,—On what do these Protozoa live?

The hypothesis has been advanced that the food of the abyssal Protozoa is derived from Diatoms and other forms of minute plants, which, ordinarily living at or near the surface, may, by subsiding to the depths, carry down to the animals of the sea-bed the supplies they require. Our examination of the surface-waters, however, has afforded no evidence of the existence of such microphytic vegetation in quantity at all sufficient to supply the vast demand; and the most careful search in the Globigerina mud has failed to bring to light more than a very small number of specimens of these siliceous envelopes of Diatoms, which would most assuredly have revealed themselves in abundance, had these protophytes served as a principal component of the food of the Protozoa that have their dwelling-place on the sea-bed. Another hypothesis has been suggested, that these Protozoa, which are so near the border of the vegetable kingdom, may be able, like plants, to generate organic compounds for themselves—manufacturing their own food, so to speak, from inorganic materials. But it is scarcely conceivable that they could do this without the agency of light; and, as it is obviously the want of that agency which excludes the possibility of vegetation in the abysses of the ocean, the same deficiency would prevent animals from carrying on the like process.

A possible solution of this difficulty, offered by Professor Wyville Thomson in a lecture delivered last spring, has received so remarkable a confirmation from the researches made in the *Porcupine* expedition, that it may now be put forth with considerable confidence. It is, he remarked, the distinctive character of the Protozoa, that "they have no special organs of nutrition, but that they absorb water through the whole surface of their jelly-like bodies. Most of these animals secrete exquisitely-formed skeletons, sometimes of lime, sometimes of silica. There is no doubt that they extract both of these substances from the sea-water, although silica often exists there in quantity so small as to elude detection by chemical tests. All sea-water contains a certain amount of organic matter in solution. Its sources are obvious. All rivers contain a large quantity; every shore is surrounded by a fringe, which averages about a mile in width, of olive and red sea-weeds. In the middle of the Atlantic there is a marine meadow, the Sargasso Sea, extending over 3,000,000 of square miles. The sea is full of animals which are constantly dying and decaying; and the water of the Gulf Stream, especially, courses round coasts where the supply of organic matter is enormous. It is, therefore, quite intelligible that a world of animals should live in these dark abysses; but it is a necessary condition that they should chiefly belong to a class capable of being supported by absorption through the surface of matter in solution, developing but little heat, and incurring a very small amount of waste by any manifestation of vital activity. According to this view it seems highly probable that at all periods of the earth's history some form of the Protozoa—Rhizopods, Sponges, or both—predominated over all other forms of animal life in the depths of the sea, whether spreading, compact, and reef-like, as in the Laurentian and Palæozoic Eozöon, or in the form of myriads of separate organisms, as in the Globigerinæ and Ventriculites of the chalk." [3]—*Lecture delivered before the Royal Institution.*

[3] *The Depths of the Sea*, a lecture delivered in the theatre of the Royal Dublin Society, April 10, 1869, and reprinted in SCIENTIFIC OPINION, vol. ii. p. 6.

WHAT WAS DONE IN THE SEVERAL BRITISH OBSERVATORIES IN 1869.

In Four Parts.—Part III.

Stonyhurst College Observatory.

THE principal building of this Observatory stands on slightly elevated ground in the centre of the college garden. It was built in 1838 for astronomical and meteorological observations.

The ground floor consists of a central octagon, 22 ft. across, with four transepts, each 10 ft. by 8 ft., at the four points of the compass. Over the centre of the octagon is a circular room, surmounted by a revolving cylindrical roof, 10 ft. in diameter. This upper room was built for an achromatic by Jones, equatorially mounted, of 4 in. clear aperture, and 5 ft. 6 in. focal length. A meridian circle, by the same optician, was placed in the east transept, and another transit occupied the west transept. The diameter of Jones's meridian circle is 2 ft. 6 in.; the telescope having an object-glass of 3 ft. 6 in. focal length, and 3 in. aperture. Two sidereal clocks were also procured for the observatory.

In October, 1850, the Rev. A. Weld determined very accurately the longitude of Stonyhurst by means of three of Shepherd's chronometers, the old observatory at Liverpool being chosen as the station of comparison.

Longitude of Stonyhurst 9′ 52″ 68 W. of Greenwich.
Latitude of Stonyhurst 53° 50′ 40″ N.

In 1867 the observatory underwent a considerable change. The 8-in. equatorial, which formerly belonged to Mr. Peters, was purchased by the college authorities, and a special building erected for its reception. This new observatory was placed at a considerable distance (75 yards) from the old one, for fear lest otherwise the massive iron pier on which it rests might disturb the magnets suspended in the subterranean portion of the principal building.

A circular room, 24 ft. in diameter, with a revolving dome, a transit-room of 10 ft. square, containing an instrument by Cary of 3 ft. focal length and $2\frac{3}{4}$ in. aperture, and a study 10 ft. by 12, to be devoted to spectroscopic researches, form the whole of the new observatory. The foundations of the pile for the equatorial have been constructed with the greatest care. A bed of concrete, 10 ft. square and 2 ft. thick, rests on a natural foundation of coarse growing sand. On the concrete are placed four dressed stones, side by side, forming a square, and each weighing more than 10 cwt. These four stones support an hexagonal column, 5 ft. 6 in. in diameter, each layer of which is composed of six large cut stones, and the whole is finished with a Yorkshire landing 4 in. thick. The total height from the gravel bed to the levelling screws of the instrument is about 17 ft. Underneath the floors of the building are ceiled cellars in which a hot-water apparatus has been fitted up for protection in damp weather. The support of the telescope is an iron pier cast in two pieces; viz., a foot which weighs 13 cwt., and a pillar weighing 17 cwt. The two are fastened together by iron nuts, which allow a little play in azimuth, and the foot rests on eleven blunt levelling screws.

The object-glass, made by Troughton & Simms, has a clear aperture of 8 in., and 11 ft. 6 in. focal length. The diameter of the N.P.D. circle is 2 ft. 2 in., whilst those of the R.A. and hour angle are each 1 ft. 7 in. The engineer who mounted the telescope was Napier, but the fixings of the N.P.D. circle are by Cary. The clockwork, which is perhaps the most perfect portion of the instrument, requires winding only every six hours. It goes excellently, and has no strain upon it, since it serves only to regulate the motion, the motive power being a weight suspended within the iron pier.

The telescope is well provided with eye-pieces and micrometers. The highest power is about 750.

The dome, which covers the instrument, runs on twelve 6-in.

rollers working freely between an upper and lower surface of railway metal. The flange of the upper railway metal is bolted to the sole plate of the dome. The framework of the dome is of pitch-pine, and out of the sole plate circular ribs converge to the zenith. The frame is stiffened with a reticulation of hoop-iron, and covered with ½-in. boards of pitch-pine. The outside is protected by a covering of painted canvas, and the internal finish is of American cloth of a dark colour. The whole is moved by a spur-wheel and pinion, gearing into a segmental rack, which rests on the wall-plate. The wheel is actuated by a chain. This is so placed as to be directly opposite the shutter, and therefore generally near the observer's hand. The shutter consists merely of a frame of pitch-pine, covered outside with painted canvas and inside with American cloth. It is worked by pulleys and bevel gearing, and its width is 4 ft. 6 in.

During the past year considerable advance has been made towards rendering the observatory practically complete. A stone pier has been erected on a brick foundation in the open air, and an equatorial mounting attached to it. This mounting can be used for any tube, but it is principally intended for a 7½-in. Newtonian, with which the heavens can be freely swept without the necessity of moving a large dome. The two observatories have been connected by an underground wire to avoid the necessity of daily observing clock stars with two transit instruments, and to have a sure check on the time at either observatory. A direct vision spectroscope has been adapted to the equatorial by Browning. In the summer six compound prisms were procured from Hoffman of Paris, and these are being mounted for a spectroscope by Troughton & Simms. A hot-water apparatus has been arranged for the protection of the equatorial dome and the adjacent rooms. Two observing-chairs have also been made for the large telescope; and, lastly, a new 8-in. object-glass has been ordered from Dallmeyer, the present glass not being considered sufficiently good for the excellent mounting of the instrument.

The work done has so far been mostly of a tentative character. Observations of the moon's surface, measures of the diameters of planets, and of the distances between double stars, Winnecke's comet, the November meteors, and some preliminary work with a direct-vision spectroscope, constitute the miscellaneous observations of the last twelve months. Correct time for the magnetic and meteorological self-recording instruments being a want continually felt, no fine night is allowed to pass without clock-stars being observed.

Th meteorological observations, made with instruments that have been carefully compared at Greenwich or at Kew, extend in an uninterrupted series over twenty-three years.

In 1866 Stonyhurst was chosen as one of their three English meteorological stations by the Board of Trade, and was provided accordingly with self-registering barometer, thermometers, and anemometer. These instruments arrived in December, 1867, and hourly readings, as also the maxima and minima of the curves traced by them, have been taken here since January 1, 1868. Both the curves and the readings are forwarded weekly to the Central Observatory at Kew.

A monthly summary of the results obtained with the meteorological instruments has been printed for private circulation during the past ten years, and a table of the reduced monthly magnetic observations is now added to the yearly meteorological means.

The magnetic department is at present the most complete portion of the observatory. A continued series of monthly determinations of the dip, horizontal force, and declination, extend over somewhat more than six years. These have been reduced this year for the purpose of calculating the annual inequalities, &c. Previous to 1863, when a small chronometer was replaced by Frodsham's No. 3148, only occasional observations were made with the dip circle, No. 32 of Barrow and Jones's unifilar, purchased in July, 1858; but these scattered results are of considerable use for finding the secular variation of the magnetic elements. A suitable building in a retired part of the college garden has been erected for these instruments.

During the long vacations of 1868 and 1869 a magnetic survey of the whole of France has been made with the Stonyhurst magnetic instruments, and at the expense of the college authorities. The results of the survey of the west of France, made in 1868, were presented to the Royal Society in June last, and the more numerous series of observations taken in 1869, in the east of France, are at present in process of reduction.

In 1866 a grant was made by the Royal Society towards the expense of a set of self-recording magnetographs for this observatory. In consequence, two subterranean chambers were built adjoining the old observatory. One is a photographic room, 15 ft. by 12 ft. The other, a chamber 20 ft. by 18 ft., in the centre of which stand the pillars supporting the three magnetographs, with two additional pillars holding telescopes, by which the observer is able to read, at any moment, the state of the magnets without interfering with the continuous photographic record. This last room is well guarded against all damp or variation of temperature. The roof is arched, with two rings of brick set in blue lias lime, and the whole covered with 6-lb. lead, and then with earth and gravel. The walls are three in number. The inner one is a single brick wall set in hydraulic lime. Surrounding this is a cavity for air 3 in. wide, with air-holes 1 ft. apart, all round the room. Enclosing this is a rubble wall 2 ft. thick. And at the outside of all, as a protection from the surrounding earth, is 1 ft. of loose rubble, which serves admirably for drainage. The flagged floor is built upon piers, and is thus raised 18 in. above the sand. Owing to these precautions the room keeps remarkably dry, and the temperature may be considered almost constant.

Continuous photographic records have been obtained of the declination, and of the two components, horizontal and vertical, of the intensity since January, 1868. The curves traced during the magnetic storms, which were coincident with the grand auroral displays of April and May last, were of the most perfect description, a disturbance of more than 2°·5 in nine minutes, having been clearly recorded in the Declination Magnetogram. Some of the curves have been compared with those of Kew, and also with those of Signor Donati of Florence, with very interesting results.

Mr. De La Rue's Observatory.—During the past summer and autumn numerous experiments have been made to render the luminous prominences of the sun visible, when that luminary is not totally eclipsed. In order to effect this object, films of gold and other metals have been interposed between the 13-in. mirror and the eye-piece; and fluid coloured media have been also employed for the same object. These experiments will be again resumed during the present year.

An investigation is also being carried on, having for its object the production of a true parabolic figure, with greater certainty than has been obtainable by any of the methods hitherto used in making specula for reflecting telescopes.—*Annual Address to the Royal Astronomical Society.*

Property of Amorphous Silicic Acid of Absorbing Moisture from the Air.—M. Souchay states that Dr. Lippert, while assistant to Professor R. Fresenius, made the observation that amorphous silica, after having been strongly ignited in a platinum crucible, attracted moisture from the air to a large extent; in consequence whereof, and to test this fact precisely, the author instituted a series of experiments, from which the following results are drawn:—Amorphous silica is always hygroscopic after ignition; the degree of hygroscopicity differs greatly, according to the degree of heat the silica has been ignited—so that feebly-ignited silica is far more hygroscopic than when strongly ignited. When silica has been only feebly ignited, its avidity for the absorption of water, even after the lapse of a few minutes, is so great as to cause, if not taken into account, serious faults in the weighing and quantitative estimation of that substance. Crystalline silica, even when feebly ignited, is not at all hygroscopic. —*Chemical News.*

HOW TO DESCRIBE A BIRD.

IN order to facilitate the description of a bird, it is usual for the ornithologist to consider its exterior as being mapped out into sundry *regions* (see page 327), to each of which has been assigned a definite and appropriate name; with the names of these regions, and their precise application, it is requisite that the reader should be intimately acquainted.

A bird, like any other vertebrate animal, is divisible into the head, the body, and the limbs; under one or other of which divisions all subordinate parts may be classed.

The head consists of the *skull* and the *bill*, and is joined to the body by the *neck*. Commencing with the bill, we see that it is composed of two pieces, corresponding to the jaws of quadrupeds; that which is above is called the *upper mandible* (1), that which represents the under jaw is called the *lower mandible* (2). The upper mandible contains the *nostrils* (3); its highest part is called the *ridge* (4), while the corresponding ridge of the lower mandible is called the *keel* (9).

The lateral edges of the mandibles which meet when the bill is closed are called the *margins*. In some birds the margins of the upper mandible fold over those of the lower, while in others the edges meet; when this is the case, the line of junction between the two is called the *commissure* (5).

In many birds the upper mandible is continued far back over the forehead, and there dilated, so as to form a *casque* or *helmet*. In rapacious birds and parrots there is a belt of soft naked skin at the base of the upper mandible, named the *cere*, in which the nostrils are placed, while around the eye is a space, often denuded of feathers, called the *ophthalmic* region (14).

The head is that part which lies immediately over the skull, extending from the base of the beak to the commencement of the neck. The *front* or *forehead* (12) is that part of the head which lies close above the nostrils; then follows the *crown* or *summit* (17), which occupies the middle or centre of the head, forming that part which is usually occupied by the crest in birds so ornamented. The *hind head* (18) commences at the declivity of the skull; its lower portion is called the *nape* (19).

On the sides of the head the following parts have received distinct names:—The feathers that cover the ears, to save repetition, are usually called the *ears* (20): they are generally rather more rigid and their webs more disconnected than the surrounding feathers. The space between these and the corner of the mouth (usually called the *gape*) (13), is termed the *cheek*.

The parts of the Neck are thus designated:—The back of the neck is called the *upper neck*, or the *neck above* (23). The under-side of the neck is divided into three regions; first, there is the *chin* (7), or that small space just beneath the lower mandible; to the chin succeeds the *upper throat* (8), between which and the broad part of the body is the *lower throat* (21).

The Body presents the following regions:—First there is the *breast* (22), which extends over the space which covers the breast-bone. To this succeeds the *belly* (29), which is terminated by the *vent* (30). Immediately behind the vent are the *under tail-covers* (32), which are frequently of a different colour from the surrounding feathers.

On the upper aspect of the body we have the *interscapular region*, sometimes called the *back* (24), to which succeeds the *lower back* (26), which terminates at the *rump*, or that part where the *upper tail-covers* (42) are inserted.

Last of all comes the Tail, composed of long stiff feathers, called the *tail-feathers* (31), concerning which it is only necessary to observe that the two middle tail-feathers are the *intermedial*, while those on the sides are the *lateral* tail-feathers. . . . .

It will be easily understood that the importance of the individual quills as instruments of flight will depend very much upon the position they hold in the wing, of which they form so considerable a portion, and, consequently, that they have received names expressive of their relative efficiency. Those that are affixed to the bones representing the hand, by the length of their stroke, and the peculiarity of their arrangement, are obviously of primary importance, both from their size and the situation they occupy, and have consequently been named the "*primaries*," or the "*primary quills*;" they might be called with equal propriety the "*hand-quills*," a term at once expressive of the position they occupy (35). Upon the relative length and other proportions of the primary quills the shape and mechanical power of the instrument principally depend; if the first primary be the longest, the termination of the wing is sharp and pointed (*acuminate*), as in most birds that are remarkable for the swiftness of their flight; whereas if the second, third, or fourth of these quills should exceed the others in this respect, the wing becomes more and more rounded (*obtuse*), and the perfection of its action visibly deteriorated.

The "*secondary quills*," or "*secondaries*" (34), are exclusively sustained by the bones of the fore-arm; from their situation being much nearer to the shoulder-joint than the preceding, the extent of their sweep is more limited, and their stroke much feebler; they are, consequently, as their name indicates, of secondary importance in locomotion.

The *spurious*, or *bastard quills* (33), are attached to the rudimental bone that represents the thumb; their size is diminutive, and their use in flight comparatively unimportant.

The *wing covers* or *coverts* (37) are small feathers arranged in several rows, which overlap and strengthen the bases of the quills; they are often variously coloured in different species, and thus afford important features whereby they may be distinguished. Besides the above, there are certain conventional terms employed by the ornithologist that will require enumeration. The arm-part of the wing in the living bird is generally known as the *shoulder* (27); the elbow-joint is the *flexure*; while that part of the fore-arm which corresponds to the edge of the wing is denominated the *shoulder-margin* (36).—*Cassell's Book of Birds*, Part I.

REVIEWS OF BOOKS.

On the Distribution of Rain over the British Isles during the Year 1869, *as observed at about* 1,500 *Stations in Great Britain. With Remarks on various Experiments, and an Appendix on Evaporation.* Compiled by G. J. Symons, F.M.S. London: Stanford. 1870.

A FEW years ago, when Mr. Symons first commenced the meteorological movement among the amateurs of England, he was looked on by a good many wise people as a man who urged on his hobby at an insane pace. When after a time it was seen that his energy and vigour in pursuit of meteorological statistics were unabated, he was regarded as a mild enthusiast, and nowadays he is recognized, and most deservedly so, as one of the first, if not, indeed, the very first, authority on the important subject of British rainfall. The report which he issues annually, was, when first we remember seeing it, a very modest little pamphlet of a sheet or two, and in its present shape, for the year 1869, it is a handy octavo volume of nearly 200 pages, and without any diffuse or useless padding, but with a vast array of facts, which even in themselves, are far less dry reading than one not versed in meteorology would dream of, and which are of the utmost value to those who would study the statistics of weather phenomena.

Mr. Symons's report is more favourable each year; and we are glad to perceive that, owing to his increasing exertions, he is now getting workers in every part of the country, and, what is still better, getting them to record results accurately and

ILLUSTRATING THE MODE OF DESCRIBING A BIRD ZOOLOGICALLY.

Ornithological Regions of the Body of a Small Bird.

1. Upper Mandible.
2. Lower Mandible.
3. Nostrils.
4. Ridge, or Culmen.
5. Commissure, or cutting edges of the Mandibles.
6. Apex, or point of the Beak.
7. The Chin.
8. Upper Throat.
9. Keel, or Gonys.
10. } Coloured Bands, usually
11. } called Bridles and Stripes.
12. The Forehead.
13. The Gape, or Rictus.
14. Space around the Eye.
15. Lower Throat.
16. Supercilliary Region.
17. Crown, Summit, or Vertex.
18. Hind Head, or Occipital Region.
19. The Nape, or Nucha.
20. The Ear, or Ear-feathers.
21. The Throat.
22. The Breast.
23. The Neck above, or Upper Neck.
24. The Back, or Mantle.
25. Scapular Wing-covers.
26. Lower Back, or Tergum.
27. The Shoulder.
28. Body, or Lower Breast.
29. The Belly.
30. The Vent.
31. The Tail Feathers.
32. The Under Tail-covers.
33. Spurious Quills.
34. Secondary Quills, or Secondaries.
35. Primary Quills, or Primaries.
36. The Shoulder Margin.
37. Wing Covers.
38. Under-surface, or Under-part of the Body.
39. The Tarsus, or Leg.
40. The Front Toes.
41. The Hinder Toe, or Hallux.
42. Upper Tail-covers.

with uniformity. We believe that during the past year Mr. Symons has taken more than ordinary pains to insure the efficiency of his observers, and to secure an improved distribution of stations. We may form some idea of the pains and time, not to mention money, expended by the author on this subject, when we state that during the past year he has examined 115 gauges, thus distributed over the country :—

Berkshire	4	Lancashire	1
Cheshire	4	Hampshire	3
Cornwall	41	Middlesex	6
Derbyshire	1	Scilly Isles	2
Devonshire	32	Yorkshire	21

And these, be it remembered, are new gauges, which Mr. Symons examined, in order to test their capacity to supply fair results. These 115 gauges brought the whole number of those now in action in the country to 397, and the amount of travelling which the author has done to inspect all of them during the last few years in mere mileage exceeds the half-diameter of the globe!

Among points of especial interest in Mr. Symons's volume, we would refer to the account of the Rotherham experimental gauges. Those who imagine that rain-gauging merely consists in putting a bucket outside the door and measuring the quantity of water it receives in twenty-four hours, will here see what a number of varying conditions require to be considered ere anything like a scientific record of rainfall can be arrived at. This chapter, indeed, is of such great importance to meteorologists, that with Mr. Symons's permission we shall hope to reproduce it in a future number. The chapter on the rainfall of the Scilly Islands is, too, a most interesting one. We have always regarded this locality as one under the peculiar guardianship of "Nimbosus Orion," but really if the record of

22 in. annual fall be correct, the Scilly Islands are not much worse off than the drier parts of England, and, as compared with Cumberland, they may be said to have no rainfall worth speaking of. Possibly, however, when the results of evaporation are, under Mr. Symons's care, more regularly allowed for, these rainfall returns will have to undergo serious modifications. There is a feature, too, in the yearly records for the English counties which deserves Mr. Symons's mostcareful attention—it is the very great discrepancy existing between returns from the same district. This often amounts to several inches in the year, and we think it must be due to want of accuracy on the part of some of the observers. Viewed as a whole, this Report of Mr. Symons's is exceedingly satisfactory, and it shows what good work our scientific volunteers may achieve under a skilful general.

The Physical Theory of Animal Life. A Review. By Julian. Lewes: Bacon. 1870.

If the author of this essay did not commit himself as he has partially done to the speculations of Dr. Lewins we should be very much better pleased with his remarks. His ideas are not novel, but they are vigorously and cleverly expressed, and whatever we may think of the value of the materialism he has broached, we must confess that in a short space he has made a very determined onslaught on spiritualism, if we may use the word antithetically and without any reference to table-turning. The author should have gone further in his line of argument, and he would have come to pure Berkleyism, or, as we should prefer to style it, Phenomenalism. This essay is not strictly impartial, and in general style it reminds us of the writing of the well-known author of *Kraft und Stoff*, a book we commend to Julian as one congenial to his soul—we beg his pardon, his brain.

Ti Ika A Maui; or, New Zealand and its Inhabitants. Second Edition. By the Rev. Richard Taylor, M.A., F.G.S. London: Macintosh. 1870.

[Second Notice.]

One of the most striking, as it is certainly one of the most useful, chapters in Mr. Taylor's book is that devoted to the mythology of the New Zealanders, as deduced from the early songs and traditions which the author has been at pains to collect and translate. Some of these legends are full of poetry and sublime conception, and they display a very high degree of intelligence, and a power of grasping abstract questions not often met with among savages. In the picturesque character of the language we are reminded of many of the passages of Longfellow's *Hiawatha*; and indeed it is surprising how close a resemblance there is between the ideas of the American Indians and the Maories, and between the modes of expression employed by the two races. The subsequent chapters treat of the various characteristic rites and ceremonies, religious and profane, which exist among the New Zealanders, and these are in all cases described with a detail which only one who had given years of study to his subject could employ. Traditions, fables, songs, and names are also subjects to which several attractive chapters are devoted, and though not within the scope of these pages, Mr. Taylor's observations on each and all will be found to embody a mass of facts which may be usefully studied by the anthropologist.

Mr. Taylor's chapter on the language and its origin and relations is at once the most fascinating and, we should think, the least satisfactory in the whole book. It is full of speculation, and will be read through with the deepest interest; but when it is read, the student is left with the very unpleasant feeling that the author, without intending it, has been pleading a special cause. This is most seen in his list of words, where he endeavours to point out the relation between English, Sanscrit, &c., and Maori words. One or two examples are sufficient. Thus we are told that the word *poki* means "to poke in the earth over an oven." Here the inference is that *poki* and *poke* are related. Again, *kutikuti* is explained as "to cut with scissors;" and *pata* "to patter, as water dripping." This last little bit of philology savours so much of Cockaigne that we are, with every wish to be serious, irresistibly compelled to smile. Mr. Taylor may be right in many of his strained resemblances, but he pushes things so absurdly far in some that he really makes us sceptical as to the value of all the rest of his philological labours.

The description of the geology of New Zealand is an excellent though discursive one, and relates rather to the facts of palæontology than to the purely physical geology of the country. The author regards the island as being the last trace of the ancient Liassic epoch, and, among other points in favour (!) of this idea, he cites the analogy between Professor Huxley's recently-described *Hyperodapedon* and the Tuatara, one of the New Zealand lizards. The concluding chapters of the volume deal with the industrial products of the country, and with some of the more striking natural-history productions, and contain a brief biographical sketch of one or two of the native chiefs who have most distinguished themselves in their dealings with the colonists. The chapter on the Botany of New Zealand is condensed, and contains a good deal of matter. It embraces among other things a paper by Dr. Hooker on "Dactylanthus," a curious parasitic plant, a figure of which we hope to lay before our readers in an early number. Altogether we must say in conclusion of Mr. Taylor's volume, that it is one from which all educated readers will derive both pleasure and instruction.

Lichenum Britannicorum Enumeratio, &c. Scripsit Rev. Jacobus M. Crombie, M.A., F.L.S. and G.S.

Nearly ten years have elapsed since the publication of Mr. Mudd's *Manual of British Lichens*, and the book before us will show what additions have been made since that time to the Lichen Flora of Great Britain. During the interval, in addition to former well-known workers in the field, Mr. Crombie himself has zealously pursued this subject, and added numerous species, amongst which are many new ones, to the British list. The enumeration has been carefully compiled, according to Nylander's arrangement, and will be found invaluable not only on account of its references to works in which the species and their synonyms are described, but also on account of its giving for the first time the general distribution of species within these islands. A valuable contribution has thus been made to British phytogeography, which we may hope to see further elucidated in the author's promised paper on this subject, we need scarcely say that the book ought to be in the hands of every lichenologist.

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We cannot undertake to return rejected communications.

The Leclanché Battery.

Sir,—A few weeks since you stated that you had a Leclanché battery under observation, and I have now the pleasure to hand you some notes on the same which may be useful. About December, 1868, a battery was fitted on the lines of the Electric and International Telegraph Company between London and Birmingham, which I was shown, by the kindness of the engineer, some months afterwards. He informed me that Leclanché had presented him with a pamphlet on his invention, which, unfortunately, he had mislaid. I have tried in London and Paris, but cannot find who were the publishers. The battery had given satisfaction, but the objections to it were mainly that the porous nature of the carbon kept the connections between the cells constantly wet, and set up local action, which dissolved them, while the fumes of the ammonia injured the wires and instruments near. In my own home I have succeeded in obviating the first difficulty by using connections of platinum, held in their places by wood clips; the second must be met by removing the battery to a distance. The resistance of two cells (apparently pint size), as measured on the rheostat, was 300 in British Association units, while that of two single-fluid cells of zinc and carbon in a solution of chloride of ammonium was 360. The merits of the Leclanché battery are extreme cleanliness and constancy. The chloride of ammonium does not attack unamalgamated zinc except while contact is made, and the arrangement of the porous cell full of peroxide of manganese gets over the difficulty of polarization in the single fluid. Lastly, the battery may be left without attention for many months, and then the only requisites are a little more water and chloride of ammonium to make up for waste and evaporation. I remain, Sir, yours truly,

Hampstead, March 31. S. L. T.

Solar Spots.

Sir,—While looking at the sun yesterday morning through the medium of the fog which then prevailed, I became aware of the fact that two well-defined maculæ, or spots, are at present visible to the naked eye on the solar disk.

Judging from their respective positions one must shortly disappear, while the other, if it continue, must become more distinctly visible.

Yours truly, &c.,

April 3. A Subscriber.

In Answer to "A Young Beginner."—*From* P. W. Stuart Menteath.

Sir,—"A Young Beginner" so decidedly censures mere opinion that as there is little else in his own letter he cannot require me to pay much attention to it.

He seems to opine that the questions I have hitherto considered are difficult, and that I have evaded them without giving solutions. So far I quite agree with him; for what I have been hitherto endeavouring to establish is exactly the fact that the questions considered by Sir W. Thomson are so difficult to decide that evasion without solution is the most rational course regarding them,—as it will be regarding many questions so long as "there are more things in heaven and earth than are comprehended in our philosophy." But when "A Young Beginner" requires "solutions" and "definite proofs" in these questions, he assumes the very matter in dispute, for I argue that none can be given.

If I show that in the questions raised by Sir W. Thomson there are no grounds for deciding one way or the other, it follows—1st, that the different opinions held upon these questions establish nothing either regarding the questions or regarding the scientific merits of the holders; 2nd, that the merits of Uniformitarianism must be decided on other grounds, *or* that Uniformitarianism is unassailable.

"British popular geology" is geology until the contrary is proved; and Sir W. Thomson has attacked it. *All* geologists will reject a demand for "a great reform in geological speculation" when that demand is based on arbitrary assumptions. "But in geology as in logic," says the *North British Reviewer*, "mathematics is now advancing to play the part of Henry VIII.;" and I say that in both mathematics plays a dangerous game. A matter is *possible* until we are *sure* of the contrary. I do not expect a possibility to "satisfy any one;" but a possibility may be opposed to mere assumptions—as I opposed it. "A Young Beginner," in his first letter asked the question, "why should those who are not Darwinians wish for longer time than this?" I answered his question.

He, moreover, asked—"Does not the very form of the earth lead us to infer a beginning?" I referred him to clear grounds for inferring nothing from this form. And, further, the form of the earth is perfectly adapted to its functions, and those only who *imagine* a different antecedent form are required to account for its actual form.

I have given Sir W. Thomson's "objections" thoughtful consideration—and earnest, too, witness the strong language quoted by "A Young Beginner." There are *some* cases in which a spade should be called a spade. Yet I would observe that the letter containing the expressions referred to was written under the influence of Professor Sylvester's *Plea for the Mathematician*, which had confused my notions of scientific writing. But "the mathematician lives long and lives young," says Professor Sylvester; "the wings of his soul do not early drop off, nor do its pores become clogged with the earthy particles blown from the dusty highways of vulgar life." Happy creature! he won't mind it. I remain, &c.,

St. Jean de Luz, March 26. P. W. Stuart Menteath.

Sun Spots Visible to the Naked Eye.—*From* H. Michell Whitley.

Sir,—We are at the present time, as is generally known, passing through a period of maximum abundance of sun spots, and there are now several very conspicuous groups on the solar disk.

Three of the individual spots of these groups are of such large size that they were easily visible to the naked eye on the 27th; this

morning two spots are plainly seen, and the third, which is decreasing in size, is just perceptible. Sun spots of such a size as to be perceived by the naked eye have been often observed—Schwabe stating that when they exceed 50 seconds, they become visible to good eyes without the aid of a telescope, and Mr. A. Herschel thus saw two spots in November, 1861; but I think the appearance of three spots on the sun's disk at once must be an event of not very frequent occurrence.

Examined with the telescope seven groups of spots were discerned. The largest of these, on the 26th, consisted of a very large penumbra, inclosing two large umbra and one of smaller size; a tongue of light gradually invaded the largest umbra, and has now cut off a small portion from it. Another group consists of a splash of small spots resembling a star cluster, whilst another has two large spots leading the way, with a curved train of smaller ones following, terminating in a moderate-sized spot,—the whole group closely resembling a kite with its flowing tail.

Penarth, Truro, March 28. H. MICHELL WHITLEY.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

MARCH 24TH.—This meeting was occupied by the following report:—"On the Madreporaria dredged up in the Expedition of H.M.S. *Porcupine*," by P. Martin Duncan, M.B. Lond., F.R.S., Sec. Geol. Soc., Professor of Geology in King's College, London.—Professor Wyville Thomson, Dr. Carpenter, and Mr. Gwyn Jeffreys have placed the collection of stony corals dredged up by them in the *Porcupine* Expedition in my hands for determination. They have kindly afforded me all the information I required concerning the localities, depth, and temperature in which the specimens were found.

My report has been rendered rather more elaborate than I had intended in consequence of the great consideration of Professor A. Agassiz and Count de Pourtales in forwarding me their reports[1] and specimens relating to the deep-sea dredging off Florida and the Havana.

They have enabled me to offer a comparison between the British and American species, which I did not hope to have done before the publication of the species noticed, but not described, in this report.

CONTENTS.

I. List of the species, localities, depths, temperatures.
II. Critical notice of the species.
III. Special and general conclusions.

I. Twelve species of Madreporaria were dredged up, and the majority came from midway between Cape Wrath and the Faroe Islands. Others were found off the west coast of Ireland. Many varieties of the species were also obtained, and some forms which hitherto have been considered specifically distinct from others, but which now cease to be so.[2]

II. List of species known only on the area dredged, or in the neighbouring seas.

1. *Amphihelia Atlantica*, nobis.
2. *Amphihelia ornata*, nobis.
3. *Allopora oculina*, Ehrenberg.

List of species common to the area and to the Florida and Havana deep-sea faunas only.

1. *Balanophyllia socialis*, Pourtales, sp.
2. *Amphihelia profunda*, Pourtales, sp.
3. *Pliobothrus symmetricus*, Pourtales, sp.

These forms are not known in the West-Indian Cainozoic fauna, and they have not been discovered in any European deposits.

Lophohelia prolifera (var. *affinis*) is common to the British and Florida deep-sea faunas; but it is found fossil in the Sicilian Tertiaries, being moreover a member of the Mediterranean recent fauna.

List of species common to the area and to the Mediterranean Sea.

1. *Caryophyllia borealis*, Fleming.
2. *Amphihelia oculata*, Danvers, sp.
3. *Lophohelia prolifera*.

List of species found on the area dredged and as fossil elsewhere.

1. *Caryophyllia borealis*, Fleming. Sicilian, Miocene and Pliocene.
2. *Ceratocyathus ornatus*, Seguenza. Sicilian, Miocene and Pliocene.
3. *Flabellum Sarsii*, Sars, sp. Sicilian, Calabrian—Miocene and Pliocene.
4. *Lophohelia prolifera*, Pallas, sp. Sicilian, Miocene and Pliocene.
5. *Amphihelia miocenica*, Seguenza. Sicilian, Miocene and Pliocene.

The deep-sea coral fauna of the area dredged in the *Porcupine* and *Lightning* expeditions is therefore composed of—

5 species which have lasted since the early Cainozoic period.
1 Mediterranean species not known in Cainozoic deposits.
3 species of the deep-sea fauna of Florida and Havana.
3 indigenous species.

12

Two of the fossil species are represented in the recent Mediterranean fauna.

If the species which I have absorbed into others (in consequence of the light thrown upon the amount of variation in the deep-sea corals) were counted, the fossil forms would be in all 8.

The greatest depth from which Madreporaria were dredged was 705 fathoms, and the lowest temperature of the water in which they lived was 29·9°.

[Dr. Duncan then gave a long detailed account of the several species, and their conditions of life.]

Owing to the great length of Dr. Davies's paper, which threatens to extinguish our reports of Societies, we propose to publish it in parts, as a supplement to each week's report.

"On the Law which regulates the Relative Magnitude of the Areas of the Four Orifices of the Heart," by Herbert Davies, M.D Cantab., F.R.C.P; communicated by W. H. Flower, F.R.S.—I propose in this communication to inquire whether any law can be discovered which determines the relative magnitude of the areas of the tricuspid, pulmonic, mitral, and aortic orifices—the four principal openings in the heart.

Although to ordinary observation these orifices appear to exhibit no mutual relationship of size, there can be no doubt that an instrument so accurate in the adaptation of its valvular apparatus, and so exact in the working of its different parts, must reveal on close examination the existence of laws, which not only determine the force required to be impressed upon the blood traversing its chambers, but also the relative sizes of these apertures to one another.

The facts and inferences which I shall adduce on this subject will tend, I believe, to throw some light upon the mechanism of the heart in its healthy state, and will explain also some points of practical interest in the pathology of that organ.

To M. Bizot in France, and Drs. Peacock and Roid in this country, are we mainly indebted for the most careful and trustworthy measurements of the circumferences of the orifices. Their measurements have been recorded to the minuteness of the thousandth part of an inch, and yet it will, I believe, be readily admitted that the results in the form given by these distinguished observers help us but little in obtaining any definite idea of the mutual relationship of the areas of the orifices, and are destitute of any practical value in our study of the mechanism of the heart itself.

Had the observations been pushed further, or rather had the figures been worked out into some distinct and definite shape, these observers could not have failed to discover an interesting and important law presiding over the areas of these orifices, and they would thus have been enabled to utilize a multitude of measurements which had been obtained by considerable labour and patient research.

Taking the measurements given by Dr. Peacock in the Croonian Lectures for 1865, we find the mean circumferences of the four orifices, expressed in English inches, to be as follows:—

	Males.	Females.
Tricuspid	4·74	4·562
Pulmonic	3·552	3·493
Mitral	4	3·996
Aortic	3·14	3·019

I will now place these valuable facts into another shape by calculating from these measurements of *circumference* the *areas* of the respective openings.

The circumference of a circular opening being known, its radius is determined from the formula

$$\text{circumference} = 2\pi r,$$

where $\pi = 3{\cdot}1415$; and the radius being thus determined, the *area* of the opening is calculated from the formula

$$\text{area} = \pi r^2.$$

[1] "Contributions to the Fauna of the Gulf-stream at great depths," by L. F. de Pourtales, 1st and 2nd Series, 1868. *Bull. Mus. Comp. Zool.*, Harvard College, Cambridge, Mass., Nos. 6 and 7.

[2] One specimen came from the *Lightning* Expedition. It must be remembered that all the deep sea-corals known to British naturalists were not dredged up. The *Stylaster roseo*, for instance, was not amongst the collection.

The mean areas of the four orifices thus obtained are found to be as follows:—

	Males.	Femal s.
Tricuspid	1·78 sq. in.	1·6 sq. in.
Pulmonic	1	·97
Mitral	1·27	1·27
Aortic	·78	·67

Or, for facility of recollection, we may consider the respective mean areas in the male to be:—

Tricuspid	1¾ sq. in.
Pulmonic	1
Mitral	1¼
Aortic	¾

whence it is obvious that the apertures differ very considerably in area from each other, the tricuspid having the largest area, its orifice being more than double the size of the aortic opening.

Irregular, however, as these areas may appear to be in magnitude with respect to each other, we shall find, on pushing our observations further, that there is a distinct and constant law presiding over them, and this law is discovered when we compare the *ratios* of the areas of corresponding orifices. Thus,

$$\frac{\text{Area of tricuspid}}{\text{Area of mitral}} = \frac{1{\cdot}78}{1{\cdot}27} = 1{\cdot}4 \text{ nearly;}$$

$$\frac{\text{Area of pulmonic}}{\text{Area of aortic}} = \frac{1}{{\cdot}78} = 1{\cdot}3 \text{ nearly;}$$

or, in other words, the area of the tricuspid appears from these calculations to bear nearly the same relation to the area of the mitral which the area of the pulmonic does to that of the aortic orifice, *i.e.*, were the tricuspid, for example, twice the size of the mitral orifice in area, the pulmonic would be twice the size of the aortic orifice in area, the two ratios differing from each other only by one-tenth.

Again, if we adopt Dr. Reid's measurements of the circumference of the healthy cardiac orifices (these measurements being given in Dr. Peacock's work), we shall find this law to be more conclusively proved.

According to Dr. Reid the measurements of the circumferences are as follows:—

	Male.	Female.
Tricuspid	5·3 in.	4·9 in.
Pulmonic	3·7	3·5
Mitral	4·6	4·2
Aortic	3·2	3

from which data we find the areas to be:—

Tricuspid	2·24 sq. in.	1·9 sq. in
Pulmonic	1·01	1
Mitral	1·7	1·4
Aortic	·8	·71

And if we make the same comparison of areas as we did in Dr. Peacock's measurements, we find:—

Males.

$$\frac{\text{Area of tricuspid}}{\text{Area of mitral}} = \frac{2{\cdot}24}{1{\cdot}7} = 1{\cdot}31$$

$$\frac{\text{Area of pulmonic}}{\text{Area of aortic}} = \frac{1{\cdot}01}{{\cdot}8} = 1{\cdot}26$$

Difference of the ratios = ·05

Females.

$$\frac{\text{Area of tricuspid}}{\text{Area of mitral}} = \frac{1{\cdot}9}{1{\cdot}4} = 1{\cdot}36$$

$$\frac{\text{Area of pulmonic}}{\text{Area of aortic}} = \frac{1{\cdot}0}{{\cdot}71} = 1{\cdot}40$$

Difference of the ratios = ·04

It is well known that no measurements can be taken of such orifices as those of the heart without liability to error occurring from the varying elasticity of the circumferences of the openings; but no one can observe the close identity of the respective ratios without concluding that the ratios are really identical, and that the small differences in the calculated results depend entirely upon the impossibility of obtaining absolutely correct measurements of the boundaries of such openings. It is clear, therefore, that in whatever proportion the tricuspid is larger than the mitral, in exactly the same proportion is the pulmonic larger in area than the aortic orifice. This rule applies, of course, to the human heart only in its healthy state; but I shall show that its application is of practical value when we consider the organ in its diseased state.

I shall now proceed to prove that the law which I have deduced from independent observations made in the healthy human heart is of far wider application, for I have found by my own measurements that a comparison of the areas of the same orifices in animals reveals the same result.

The following are the facts at which I have arrived by careful and repeated measurements of the cardiac apertures in different animals.

The measurements are individual, and not mean, and therefore less liable to error.

Horse.

	Circumference.	Area.
Tricuspid	9·25 in.	6·8 sq. in.
Pulmonic	6·5	3·6
Mitral	8·2	5·3
Aortic	5·9	2·8

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{6{\cdot}8}{5{\cdot}3} = 1{\cdot}283$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{3{\cdot}6}{2{\cdot}8} = 1{\cdot}285$$

Difference of the ratios = ·002

Donkey.

	Circumference.	Area.
Tricuspid	6·2 in.	3·06 sq. in.
Pulmonic	4·1	1·34
Mitral	5·5	2·40
Aortic	3·7	1·09

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{3{\cdot}06}{2{\cdot}40} = 1{\cdot}27$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{1{\cdot}34}{1{\cdot}09} = 1{\cdot}23$$

Difference of the ratios = ·04

Ox.

	Circumference.	Area.
Tricuspid	7·5 in.	4·48 sq. in.
Pulmonic	4·8	1·83
Mitral	6·6	3·47
Aortic	4·2	1·40

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{4{\cdot}48}{3{\cdot}47} = 1{\cdot}29$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{1{\cdot}83}{1{\cdot}40} = 1{\cdot}30$$

Difference of the ratios = ·01

Calf.

	Circumference.	Area.
Tricuspid	5 in.	2 sq. in.
Pulmonic	3·2	·81
Mitral	4·3	1·47
Aortic	2·7	·58

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{2}{1{\cdot}47} = 1{\cdot}36$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{{\cdot}81}{{\cdot}58} = 1{\cdot}40$$

Difference of the ratios = ·04

Sheep.

	Circumference.	Area.
Tricuspid	3·7 in.	1·09 sq. in.
Pulmonic	2·5	·49
Mitral	3·2	·81
Aortic	2·1	·35

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{1{\cdot}09}{{\cdot}81} = 1{\cdot}34$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{{\cdot}49}{{\cdot}35} = 1{\cdot}40$$

Difference of the ratios = ·06

Sheep.

	Circumference.	Area.
Tricuspid	4·25 in.	1·435 sq. in.
Pulmonic	2·70	·580
Mitral	3·70	1·090
Aortic	2·30	·420

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{1{\cdot}435}{1{\cdot}090} = 1{\cdot}316$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{{\cdot}58}{{\cdot}42} = 1{\cdot}380$$

Difference of the ratios = ·064

Pig.

	Circumference.	Area.
Tricuspid	3·95 in.	1·24 sq. in.
Pulmonic	2·55	·51
Mitral	3·50	·97
Aortic	2·25	·40

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{1\cdot24}{\cdot97} = 1\cdot278$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{\cdot51}{\cdot40} = 1\cdot275$$

Difference of the ratios = ·003

Pig.

	Circumference.	Area.
Tricuspid	3·6 in.	1·03 sq. in.
Pulmonic	2·5	·49
Mitral	3·2	·81
Aortic	2·1	·38

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{1\cdot03}{\cdot81} = 1\cdot27$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{\cdot49}{\cdot38} = 1\cdot29$$

Difference of the ratios = ·02

Dog.

	Circumference.	Area.
Tricuspid	3·65 in.	1·07 sq. in.
Pulmonic	1·9	·287
Mitral	3·15	·79
Aortic	1·6	·204

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{1\cdot07}{\cdot79} = 1\cdot36$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{\cdot287}{\cdot204} = 1\cdot40$$

Difference of the ratios = ·04

Dog.

	Circumference.	Area.
Tricuspid	2·9 in.	·69 sq. in.
Pulmonic	1·6	·204
Mitral	2·5	·49
Aortic	1·4	·156

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{\cdot69}{\cdot49} = 1\cdot40$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{\cdot204}{\cdot156} = 1\cdot31$$

Difference of the ratios = ·09

From these facts we may fairly conclude that in the healthy human heart, and most probably in the hearts of most animals, the areas of the four apertures bear an exact mathematical relationship to each other, and consequently that if the areas of any three of the openings be known, the area of the fourth orifice can be correctly calculated.

I need scarcely dwell upon the importance of a knowledge of this law in estimating the amount of contraction or dilatation of orifice which a morbid specimen may present. I will, however, now show from my own measurements how this law was applied, and how closely the observed and calculated results agreed in the case of a strong healthy man who died in the London Hospital from the effects of a fractured spine. The heart was perfectly healthy. I carefully measured the pulmonic, mitral, and aortic orifices, calculated the area of the tricuspid, and then measured its circumference. Having worked out its area, I was able to observe what difference existed between the result of actual measurement and the result derived from "the law of the orifices" which I had discovered.

Human Heart.

	Circumference.	Area.
Pulmonic	3·55 in.	1·003 sq. in.
Mitral	4·20	1·405
Aortic	3·10	·765

Now, by the law of the orifices,

$$\frac{\text{Area of tricuspid}}{\text{Area of mitral}} = \frac{\text{Area of pulmonic}}{\text{Area of aortic}}$$

$$\text{Area of tricuspid} = 1\cdot405 \times \frac{1\cdot003}{1\cdot972} = 1\cdot972.$$

By measurement,—

	Circumference.	Area.
Tricuspid	5·1 in.	2·070 sq. in.

Area of tricuspid by measurement = 2·070 sq. in.
Area of tricuspid by calculation = 1·972

Difference between calculated and observed results ..... = ·098

The calculated and observed results differ so little from each other that this case evidently strongly corroborates the correctness of the law which I believe regulates the relative magnitude of the areas of the four cardiac openings.

If, moreover, we scrutinize the measurements, we shall observe an equally inportant fact, that the ratio of the areas of any two corresponding orifices is almost constant in the same, and, I may almost add in all animals, man included.

Thus the area of the tricuspid is nearly 1·3 times the area of the mitral orifice, and the area of the pulmonic of course bears the same proportion to that of the aortic opening. By measuring, therefore, the two orifices of the right (supposed healthy), we are enabled by this law to deduce approximatively the magnitude of the areas of those of the left heart and *vice versâ*. One healthy orifice being known, the area of the corresponding opening in the other side of the heart can be approximately calculated; and should the latter be diseased, its deviation from the normal area can be determined, and the amount of abnormal contraction or dilatation fairly estimated.

(*To be continued.*)

GEOLOGICAL SOCIETY.

MARCH 23RD.—Warington W. Smyth, Esq., M.A., F.R.S., vice-president, in the chair. Frederick Antony Potter, Esq., B.Sc., Assoc. Royal School of Mines, Cromford, Derbyshire, was elected a fellow of the society. The following communications were read:—

Professor Huxley communicated a letter received by him from Dr. Emanuel Bunzel, of Vienna, giving a short account, illustrated with figures, of the posterior portion of a skull obtained by Professor Suess from a coal-mine of Upper Cretaceous (Gosau) age. Dr. Bunzel stated that at the first glance this skull appeared to possess Reptilian characters, but that the convexity of the occiput, and its gentle passage into the roof of the skull, the presence of a transverse ridge in the occipital region, the absence of sutures, the globular form of the condyle, and some other peculiarities, prevent the animal to which this skull belonged from being referred to any known order of Reptiles. The author compared this fragment of a skull with that of a bird, and suggested the establishment of a new order of fossil reptiles (Ornithocephala), closely related to Prof. Huxley's Ornithoscelida. He proposed to refer his fossil to a new genus, which he named Struthhiosaurus.

"On the Discovery of Organic Remains in the Caribean Series of Trinidad," by R. J. Lechmere Guppy, Esq., F.L.S., F.G.S.—The author described the rocks of the "Caribean Group" as consisting of gneiss, gneissose, talcose, and micaceous slates, and crystalline and compact limestones, and remarked upon the probable distribution of rocks of the same series on the continent of South America. In Trinidad the uppermost member of the series is a compact dark blue limestone, which contains obscure, but very abundant fossils; in the subjacent clay-slates and quartz rocks calcareous strings and bands containing more distinct traces of organisms occur. The author believed that he had detected an Eozoon (which he called *E. caribeum*), a Favosites (named *F. fenestralis*), a coral, and fragments of Echinoderms. He considered it probable that the Caribean series was pre-Silurian.

Discussion.—Dr. Carpenter, from the slight examination he had been able to make of the fossils, was unwilling to speak decidedly about them. There was, however, no doubt of numerous organic remains occurring in the rocks, and among them serpuline shells and Echinoderms. As to the supposed Eozoon, he had not been able to recognize any of the characteristics of that fossil; and by treating the Trinidad specimens with acid, he found no traces of structure left, and yet there had not been sufficient metamorphism to destroy other organisms. In some dredgings from the Ægean Sea he had found fragments of Echinoderms and other organisms, in which a siliceous deposit had replaced the original sarcode in the same manner as had occurred in the Canadian Eozoon, thus proving the possibility of this form of substitution, which had been warmly contested.

Mr. Tate offered some suggestions as to the age of these beds, which were certainly older than Neocomian. The Californian gold-bearing beds appear to be Jurassic. Similar beds occurred in New Mexico, Guatemala, and were observed by him in Nicaragua and Costa Rica. These present lithological and mineralogical affinities to the Venezuelan and Trinitatian metamorphic series, and were conjectured to be of the same age.

"On the Palæontology of the Junction-beds of the Lower and Middle Lias in Gloucestershire," by Ralph Tate, Esq., A.L.S., F.G.S.

—The object of this paper was to show that the attachment of the zone of *Ammonites raricostatus* to the Lower Lias and that of *A. Jamesoni* to the Middle Lias harmonizes with the distribution of the organic remains: 50 species were catalogued from the united zones of *A. oxynotus* and *A. raricostatus*, 8 of which pass up into the Middle Lias, whilst 13 occur in the lower horizons; 115 species were enumerated as occurring in the zone of *Ammonites Jamesoni*, 60 of which pass to higher zones, whilst 11 made their first appearance in the Lower Lias; the number of species common to the contiguous zones being 14.

The author inferred that, as the conditions of depth and deposit of the upper part of the Lower Lias are repeated in the lower part of the Middle Lias, accompanied by a total change in the fauna, a break in the stratigraphical succession existed between the Lower and Middle Lias. This view is supported by the fact of the numerical decrease of species in passing up through the several stages of the Lower Lias, and that of the introduction of many new generic types with the zone of *Ammonites Jamesoni*. Many new species were described.

Discussion.—Prof. Boyd Dawkins had attempted to test these Liassic zones as a means of classification of the rocks in Somersetshire, and the result had been that he had been unable to accept them as fixing hard and fast lines of demarcation, for he had found three of the distinctive Ammonites together in one bed. On our present shores the change of one form of molluscan life for another seemed to take place in limited areas, and to be dependent on some slight variation of physical conditions rather than on any great change. He had not been able to trace any stratigraphical unconformity between the Middle and Lower Lias in many parts of England, whatever might be the case in Gloucestershire.

Mr. Tate, in reply, gave an account of the manner in which he had arrived at his conclusions, and expressed his assent to the view that Ammonite zones were only of value over limited areas, but considered that a triple division in the Lower, and a dual division in the Middle Lias, were well established on palæontological and lithological features. The break which he had pointed out was palæontological rather than stratigraphical, though the one might be inferred from the other.

"Geological Observations on the Waipara River, New Zealand," by T. H. Cockburn Hood, F.G.S.—In this paper the author described the general features of the locality from which he has obtained bones of Plesiosaurus, Ichthyosaurus, and Teleosaurus. The bones were not obtained *in situ*, but from large boulders and blocks scattered in the ravines of the Waipara and its tributaries.

Discussion.—Prof. Boyd Dawkins remarked on the presence of Crocodilia in New Zealand being proved by the procelian vertebra.

R. H. Scott, Esq., F.G.S., communicated an extract from a letter addressed to him by M. Coumbary, Director of the Imperial Observatory of Constantinople, containing an account received from M. L. Carabello of the reported fall of a large meteorite near Mourzouk, in the district of Fezzan, in lat. 26° N., and long. 12° E. of Paris. It fell on the evening of the 25th December last, in the form of a great globe of fire, measuring nearly a mètre in diameter; on touching the earth it threw off strong sparks with a noise like the report of a pistol, and exhaled a peculiar odour. It fell near a group of Arabs, who were so much frightened by it that they "immediately discharged their guns at this incomprehensible monster."

The following specimens were exhibited:—Rock-specimens from the Caribean Series of Trinidad; exhibited by R. J. Lechmere Guppy, Esq., F.G.S. Fossils from the Gloucestershire Lias; exhibited by R. Tate, Esq., F.G.S.

ZOOLOGICAL SOCIETY.

MARCH 24TH.—Dr. E. Hamilton, V.P., in the chair.—Mr. P. L. Sclater exhibited a coloured drawing received from Dr. Salvadori, of Turin, C.M.Z.S., of a bird which Dr. Salvadori had proposed to describe as a new genus and species, but which was evidently referable to the singular pigeon recently named by Mr. Gould as *Otidiphaps nobilis*.

Mr. W. B. Tegetmeier exhibited and made remarks on a living specimen of an Axolotl (*Siredon pisciformis*) which had undergone the change into the Salamandroid form recently described by Professor Dumeril, of Paris.

A third letter was read from Mr. W. H. Hudson, C.M.Z.S., containing remarks on the ornithology of the vicinity of Buenos Ayres.

Mr. Osbert Salvin read a paper on the Birds of Veragua, based on large collections recently formed by Henrique Arce in that country, and in continuation of a former memoir on the same subject. The present communication contained an account of 214 species not given in the former list, and made altogether 434 species now known to occur in this limited district. Of these additional species several were stated to be new to science and of great interest.

Mr. P. L. Sclater read a notice of two rare species of Pheasants from Upper Assam recently added to the society's living collection. These were a Monaul (*Lophophorus Sclateri*), and a Tragopan (*Ceriornis Blythii* both lately described as new by Dr. Jerdon. For these specimens, both of which were in fine plumage and of very remarkable beauty, the society was indebted to the liberality of Major Montagu of the Bengal Staff Corps.

Mr. P. L. Sclater read some further notes on the Cuckoos of the genus Coccyzus, in continuation of a former paper on the same subject.

A communication was read from Professor J. V. Barboza du Bocage, F.M.Z.S., containing a description of a new species of Pelican from Angola, proposed to be called *P. Sharpii*.

A communication was read from Dr. J. C. Cox, C.M.Z.S., giving descriptions of eight new species of Shells from Australia and the Solomon Islands.

A communication was read from Mr. Jonathan Couch, of Polperro, C.M.Z.S., describing a new species of Aplysia, or Sea-hare, which had recently occurred on the coast of Cornwall, and which he proposed to call *A. melanopus*.

CHEMICAL SOCIETY.

MARCH 17TH.—Dr. A. W. Williamson, F.R.S., &c., president, in the chair. The following gentlemen were elected fellows:—D. Brown, A. Muirhead, T. L. Paterson, D. Penny, S. T. Smith.

The first paper read was "On Artificial Alizarine," by W. H. Perkin, F.R.S.—Mr. Perkin first entered upon a long but important account of the chemical history of alizarine and its production artificially. He then went on to say that artificial alizarine is entirely identical with the colouring matter obtained from the madder root. Both of the products crystallize in needles, which are usually curved, especially when small. They dissolve in caustic alkalies, forming violet solutions of the same tint. When applied to mordanted fabrics they produce exactly the same colours, bearing the treatment with soap equally. They also possess precisely the same tinctorial value. The colours produced on fabrics by the artificial alizarine are as fast against light as those of madder. Cupric acetate produces in their alcoholic solutions a purple colouration. Their alkaline solutions show identical absorption bands in the spectrum. Both yield phthalic acid when treated with hydric nitrate.

It may be observed that a solution of sulphoxanthraquinonic acid in alcoholic potash has a very similar spectrum as an analogous alizarinic solution; but the spectra of the respective aqueous solutions are quite different.

As a substitute for madder artificial alizarine has been objected to, on the ground that pure alizarine alone will not produce the madder colours, other colouring matters being required. But Schunck says that, after a long course of experiments, he has been led to the conclusion, that the final result of dyeing with madder is simply the combination of alizarine with the various mordants employed, and he recommends extraction from madder prints as the easiest method of preparing pure alizarine on a small scale. Mr. Perkin, on experimenting in this direction, could find nothing but alizarine in finished madder print. There is a second colouring matter in the madder root, the purpurine, but this cannot be found in the colour of the prints; if a mere trace of it were present it could easily be detected by its characteristic spectrum. It cannot be affirmed that purpurine never exists on prints dyed with madder or garancin, but it is certain that the higher the class of print, and, consequently, the more brilliant the colours, the purer is the alizarine in combination with the mordants.

Artificial alizarine as sent to the dyer and printer is not exactly pure alizarine, and generally produces, with alumina mordants, a somewhat redder shade than madder. This is due to some impurities, whose nature is, as yet, not known. Schunck has, however, already succeeded in obtaining a yellow crystalline body from the residues; but this yellow substance does not appear to have any affinity for mordants, and therefore cannot be injurious.

A good deal has been said about the supply of anthracene. It must be remembered, however, that tar-distillers have had as yet but little experience in separating this substance. Mr. Perkin's investigations on this matter have led him to believe that coal-tar contains considerable quantities of this hydrocarbon. No doubt the kind of coal used as well as the temperature employed in the gasworks, influences the quality of the tar as a source of anthracene, but upon these points no definite information has yet been obtained.

Mr. Perkin illustrated his highly interesting lecture by exhibiting samples of fabrics dyed and printed with artificial alizarine, and also by projecting the spectra of some alizarine solutions on a screen.

The following paper was "On the Combinations of Carbonic Acid with Ammonia and Water," by Dr. Divers, the reading of which, however, was, on account of the advanced hour, postponed for the next meeting (to-morrow evening), when, besides this, the following papers will be read:—"Deep Sea Water," by John Hunter, and "Refraction Equivalents of Aromatic Hydrocarbons," by Dr. Gladstone.

ROYAL GEOGRAPHICAL SOCIETY.

AT the ordinary evening meeting of this society, on Monday week, Sir Roderick Murchison, president, in the chair, there was a large

attendance of members and their friends assembled to hear Sir Charles Nicholson's account of Forrest's journey in the interior of Western Australia, and on the recent progress of Australian discovery. The expedition of Mr. John Forrest was undertaken by order of the Colonial Government of Swan River, with a view to ascertain the truth of reports that had been received of the murder many years ago of two white men far in the interior, north-east of the settled parts of the colony, who it was conjectured were a portion of the missing Leichhardt party. The expedition, according to Sir Charles Nicholson, was exceedingly well managed throughout, the native, "Jimmy Mungaro," who originated the report, forming one of the party With Mr. Forrest were associated Mr. George Monger and Mr. M. Hamersley as second and third in command, and important observations were made on the general features and productions of the country. The party started from Newcastle on the 19th of April, 1869, and reached the furthest point yet attained to the east on the 2nd of July, in 28° 41' S. lat., and 122° 50' E. long. The remains of the supposed white men turned out to be the bones of horses which had strayed from an outlying station. Several large salt lakes were discovered, one, Lake Barlee (named after the Colonial Secretary), being of irregular form, and more than 30 miles in length. The country was pronounced to be worthless for pastoral or agricultural purposes. Sir Charles then proceeded to notice the recent survey of the neighbourhood of Port Darwin, in the northern territory, which, he said, had been most injudiciously made over by the Imperial Government to South Australia. Port Darwin lies a little to the west of the Adelaide River, on the northern coast, opposite Melville Island, and the Government surveyors had gone over about a million acres of what might be considered available land, all the rest being of little or no value. The overland journey from South Australia is found to be quite impracticable, and Mr. Goyder, the colonial surveyor, was of opinion that the best route to the new settlement of Port Darwin would be that followed by Mr. Kinlay, from northern Queensland; thus Sir Charles observed, the territory so unwisely allotted was naturally dependent on Queensland and New South Wales. In conclusion, he alluded to the magnificent island of New Guinea as really forming part of Australia, being connected with our settlement at Cape York by a line of small islands. This was one of the most tempting fields of exploration that yet remained in the world. Nothing whatever was known of the interior except that lofty ranges of mountains, 10,000 ft. to 13,000 ft. high, with richly-wooded slopes, were in sight for many days together to vessels coasting along the shores, and that one large river at least, with an extensive delta, disembogued on the south coast.

In the discussion which followed the president stated that he had formerly endeavoured to impress upon our Government the necessity of reserving the northern territory of Australia as an Imperial possession, and for stations for our marine.

Mr. George Campbell mentioned the project of breeding horses in Australia for export to India from Port Darwin, but Sir Charles Nicholson explained that the intention is to transport the herds of horses (bred in the southern settlements) overland to the northern ports, and that the route they would follow must necessarily be via the interior of Queensland; the project was perfectly feasible, and the horses well suited for India.

The following new members were elected:—Lieut. J. C. Ardagh, R.E.; Somerset Beaumont, M.P.; Charles Clark; John Douglas; Lieut. S. T. Stratford Lecky; Capt. C. E. Luard, R.E.; William Martindale; John Moore; W. J. Newall; Major-Gen. the Hon. C. D. Plunkett; W. O. Stoton; Lieut.-Col. D. W. Tupper; and Thomas Wall Stephens.

THE INSTITUTION OF CIVIL ENGINEERS.

March 29th.—Charles B. Vignoles, Esq., F.R.S., president, in th chair. The paper read was descriptive of "The St. Pancras Statio and Roof, Midland Railway," by Mr. W. H. Barlow, F.R.S., M.Inst C.E.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

March 10th.—The president, Mr. T. H. Hennah, in the chair. A special meeting to receive from the committee a report on the advisability of forming a Microscopical Section, a summary of which is appended:—

It having been suggested that the usefulness of the Brighton and Sussex Natural History Society would be much extended if increased facilities could be afforded to its members for microscopical study, the committee recommended that as microscopical examination and the use of the microscope were almost indispensable to the pursuit of knowledge in natural history, it appeared to be advisable to form a section of the society, to be called the "Microscopical Section," which should provide for the study of subjects connected with the use of the microscope, and for the more frequent intercourse of such members of the society as were interested in microscopical study; that these objects could be attained by monthly meetings of the section, when papers on strictly microscopical subjects could be read, such reading to be restricted to twenty minutes, so that time might be afforded for the examination of objects and for the comparison of observations; by the formation of a cabinet, to which members be invited to contribute slides, particularly of such objects as tended to illustrate the natural history of Sussex (members to have specimens from the cabinet for home examination), and by the encouraging of the exchange of slides among the members. The section to consist of all members of the society who signify their wish to the secretaries to join the section. The government to be under the present officers of the society until the annual meeting in September, when the committee shall suggest rules for its future government; the meetings to be held on the fourth Thursday in each month at eight o'clock, when the chair shall be taken by the president, or, in his absence, by a member of the committee. After the transaction of the ordinary and special business of the evening, the meeting shall resolve itself into a conversazione at which slides illustrative of the subject of the meeting shall have precedence of other objects of interest and novelty. Before separating the subject for the next meeting shall be announced.

On the motion of Mr. Haslewood, seconded by Mr. Woufor, it was resolved "that the report of the committee be received, approved, entered on the minutes, and acted upon," the effect of which is to establish a microscopical section, and to make the meetings of the society twice instead of once a month, one for the general, and the other for microscopical subjects in relation to natural history.

The meeting then became general, when a paper by Mr. Clifton Ward, F.G.S., "A Sketch of the Geological History of England, so far as it is at present known," was read by Mr. Woufor, hon. sec., in which, from the earliest dawn of the Cambrian period, to the present day, the changes produced by depression, deposition, elevation, denudation, &c., together with an account of the various animal and vegetable types of the different periods, were graphically described, and the amount of land above water in England at the different periods was represented by a series of 15 charts.

It was announced that the *Bryological Flora of the County of Sussex* would soon be ready for distribution, the society having determined to publish it at once, instead of waiting until the issue of the annual report in September.

BOSTON (U. S.) NATURAL HISTORY SOCIETY.

March 16th.—In consequence of a violent storm there was no quorum, and a somewhat informal meeting was held, Mr. W. T. Brigham in the chair. The secretary read a paper presented by Mr. F. W. Putnam, of Salem, entitled "Note on the Occurrence on the Atlantic Coast of America of two Species of Hemiramphi, heretofore known only from the South Pacific and Indian Oceans."

Mr. Putnam referred to the five forms of Hemiramphus described by Dr. Günther in his valuable *Catalogue of the Fishes of the British Museum*, and said that while agreeing with Dr. Günther that the teeth are too rudimentary to warrant the establishment of genera based on them alone, yet he thought the characters afforded by the head, body, and fins, were sufficient to establish these groups as generic; certainly there could be no question as to the group under consideration.

Valenciennes has described two species of Hemiramphus with very long jaws, long bodies, and long pectoral fins,—one from the Bay of Bengal, figured in the illustrated edition of *Règne Animal*, which he called *H. longirostris*, on account of its very long jaw; and another, with a still longer jaw, from De Peysters Island (South Pacific), in the *Hist. Nat. Poiss.*, as *H. macrorhynchus*.

In 1859 Gill founded the genus *Euleptorhamphus*, a Hemiramphus with tricuspid teeth in the lower jaw, and described *E. Brevoortii*, a species closely allied to *H. macrorhynchus* and *H. longirostris*, and, on account of the teeth, considered it not only a distinct species, but the type of a new genus.

In September, 1869, Mr. Putnam received from Mr. Francis Gardner a fish, caught at Nantucket, Mass., which appeared to him to be the same as *H. longirostris* of Valenciennes. On looking over the collection of the Academy at Salem, he found two others, one from Cayenne, Guiana; and the other, presented 70 years ago by Capt J. Cheever, from some locality unknown, both of which he considered to be the same as *H. macrorhynchus*, Val. In the museum of the Boston Society of Natural History he had found four specimens, locality unknown, which were unquestionably the same as the one from Nantucket. In the museum of comparative zoology at Cambridge, he found three specimens from Hawaii, which he was satisfied were the same as the Nantucket specimen.

Mr. Putnam did not consider the character of tricuspid teeth in *E. Brevoortii* as of much importance, as one of the three specimens in the Cambridge Museum had tricuspid teeth in the lower jaw, while the others had simply conical teeth. In one of the specimens from the museum of the Boston Society, the back teeth were tricuspid, while the front ones were simple. He had not been able to detect tricuspid

teeth in the two specimens which he considered as *H. macrorhynchus*, though he had found them in the three specimens which he had identified as *H. longirostris*. This character, he said, could not be considered as of specific importance.

The secretary next read the title only of a paper presented by Mr. W. H. Dall, of Washington, D.C., on "A Revision of the Classification of Mollusks."

He also read a paper presented by Mr. L. Trouvelot, of Medford, Mass., "On the Growth of Trees."—The writer referred to the frequent appearance of trees having their branches permanently bent in a certain direction, generally to the E. or S.E., or perpendicular to the magnetic meridian, and spoke of the theories which have been advanced to account for it: such as the influence of the prevailing winds; the rotary motion of the earth; or magnetic currents. He did not think it owing to the winds, for he had observed it in trees in sheltered places. He had also observed that some trees were more affected in this way than others: the cherry-tree most, the maple less, and the apple and oak least of all. The writer called attention to the bearing of this subject upon agriculture, and inquired whether the frequent death of trees after transplanting is not owing to their being set in a different position from that they originally held. He would suggest the importance of observing whether this phenomenon is observable all over the globe, or is it confined to any particular locality; and also as to the kind of trees exhibiting this peculiarity in the greatest degree.

In a few remarks on this paper, the chairman stated that he had found the maple and silver-leaf poplar (*P. alba*) often bent in this way; and, contrary to Mr. Trouvelot's experience, had found the apple, especially the native apple, to exhibit this turning in a marked degree. He had transplanted a tree thus bent, turning it 180°, and found that the tree did not suffer. He had found no preponderance of wood on either side of the trunk of trees exhibiting this peculiarity; but the rings of growth were uniform.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, MARCH 28TH.—In the absence of the president, vice-president, and the two secretaries, M. Chevreul presided.

M. Trécul explained, with the aid of diagrams, the results of numerous observations made by him on the difference presented in the insertion of petioles according to the mode of vasculary arrangement in plants.

M. Jamin also explained the method followed by him in some recent experiments which he has made in conjunction with M. Amaury, to determine the specific heat of liquids and gases, and although those experiments are not yet of a nature to be published, M. Jamin thought it necessary at present to point out some of the results of those experiments, which tend to confirm those already published by M. Hirn, and which are in opposition to those previously announced by MM. Pflaundler and Platter. The latter physicists have concluded from a series of experiments tending to determine the calorific capacity of water at temperatures near its maximum density, that far from being almost constant and equal at unity, as has been stated, its capacity on the contrary varies remarkably. The following are the values that they have found:—

0·00	.....	1·0000000	5·50	.....	1·1724601
0·50	.....	0·9647665	6·00	.....	1·1863882
1·00	.....	0·9512754	6·50	.....	1·1933497
1·50	.....	0·9548597	7·00	.....	1·1928436
2·00	.....	0·9712580	7·50	.....	1·1850746
2·50	.....	0·9966152	8·00	.....	1·1706537
3·00	.....	1·0274821	8·50	.....	1·1505976
3·50	.....	1·0608154	9·00	.....	1·1263292
4·00	.....	1·0939781	9·50	.....	1·0996774
4·50	.....	1·1247388	10·00	.....	1·0728772
5·00	.....	1·1512726			

From these numbers it would seem that the capacities at 1·50° and 6·50° differ by themselves nearly 20 per cent. Such a variability would constitute one more irregularity to be added to that already presented by the water at 4°.

M. Hirn, wishing to ascertain if this anomaly was real, or if it only resulted from errors in the experiments, or in the method itself, proceeded to a new determination of the calorific capacity of water near the maximum of density, following another from that already tried by MM. Pflaundler and Platter. The latter have employed the mixture method. Two masses of water weighed exactly, taken at different temperatures, exactly estimated also, were rapidly mixed; then they took the temperature of the mixture, and with the aid of this and a great number of other experiments made in the varied conditions of weights and temperatures, they have arrived at the solution of the problem.

M. Hirn proceeded differently. The following is the principle of his method:—Having added successively to the same mass of water equal quantities of heat, he then proceeded to measure the increase of temperature produced by each of those additions, it is sufficient to say that the results of his experiments do not accord with those of MM. Pflaundler and Platter.

After a discussion on the errors which may have influenced both the methods, M. Hirn concluded by saying that it appeared difficult to admit that the calorific capacity of water about the maximum of density varied in the manner indicated by the preceding table as he believed it to increase nearly regularly from 0° to 10°. However, as he recognized the work of MM. Pflaundler and Platter to have been executed by skilled hands with the aid of the most simple method, he desired to ascertain the origin of the discordance. On this subject M. Hirn remarked, Was it not possible that the same body and same mass of water receiving an even quantity of heat, takes different temperatures according to the manner in which the addition of heat is made? He said in his method a constant quantity of water is forced to partake of successive and constant quantities of heat, and that in that of MM. Pflaundler and Platter they combined two masses of water with two different temperatures.

M. Hirn asked if, in the second case, it was certain that all the heat contained in excess in the hottest mass is manifested by the thermometer at the moment of its dispersion into the coldest one. The force of M. Hirn's remarks is slightly now diminished, since M. Jamin, by following another method, has arrived at results coinciding with M. Hirn's, and differing from those of MM. Pflaundler and Platter. He has found, by eight series of experiments, that there is no irregular change whatever towards 4°.

This communication gave rise to some observations from M. Regnault, who entered into some lengthened details on experiments which he himself has made on the same subject which have not yet been published. He is convinced from these experiments that there is somewhere about the maximum of density a slight perturbation, of whose value he has not yet been able to determine. He thinks that in the principle followed by M. Jamin there is a source of error which renders the results hardly worthy of confidence.

The correspondence was then presented by M. Elie de Beaumont, and various other communications were presented. The Academy then resolved itself into a secret committee.

ROYAL INSTITUTE OF LOMBARDY.

MILAN, FEBRUARY 24TH.—The first paper was read by Dr. Maggi, on the lesser-known languages of Ancient Italy.

This paper gave rise to some remarks from MM. E. E. Lombardini and Rossi, and some objections on the part of the secretary, Signor Ascoli.

The Marquis Gerolamo d'Adda read an account of some of his researches on Roman arts and industry.

Dr. Lemoigne described a case of removal of the cerebellum in a bird. He exhibited the animal to the Academy, and proved that it showed no remarkable alteration of function.

Professor Amati read a paper on primary and secondary methods of education.

Professor Biffi presented the Academy, in the name of the author, Dr. Achille Visconti, with a work entitled "Chemical and Anatomical Account of a Case of Echinococcus of the Cerebellum."

NOTES AND MEMORANDA.

Observations on Sound in the Lake Tunnel at Chicago.—The eighth Annual Report of the Board of Public Works, of the city of Chicago, in giving a history of the lake tunnel, says that observations on sound were frequently made during the progress of the work. The first distinct notice of anything of this kind was when the tunnel had been made one hundred yards from the land shaft. Just above the tunnel is the breakwater inclosing the inlet basin. The outside of the breakwater consists of round piles, laced 1 ft. to 2 ft. apart. The waves could be distinctly heard in the tunnel below, striking those piles through 60 ft. of earth. The next observation was the passing of propellers and tugs, when the tunnel reached half a mile or more out. The different noises made by a vessel or engine passing overhead could be heard as distinctly through 30 ft. to 40 ft. of earth as on the surface of the water. It was considered a matter of much interest to determine how far sound could be heard through the clay. The miners thought it could not be more than 150 ft. to 200 ft. In order to be certain, observations were made when the faces were 800 ft. apart, and sounds of blows of iron on stone or iron in the clay, but not on the clay itself, could be heard with great distinctness. Whether the sounds passed through 800 ft. of clay, or first through 30 ft. of clay, then through 800 ft. of water and then through 30 ft. of clay, is a question—probably the latter.

A Substitute for the Platinum Still.—M. Cotelle, says the *Pharmacist*, has invented a cheap substitute for the platinum still used in distillation of sulphuric acid. It consists of a stone tower, into which the acid drops in small quantities, while a current of hot air enters at the bottom and drives over the acid, which is condensed in the usual way.

The White Hand.—Under this name we have received from Messrs. Lillian a toilet preparation, which, without having any injurious qualities, appears to improve the appearance of the skin by preventing the hurtful action of the harsh winds of March.

SCIENTIFIC DIARY.

WEDNESDAY, April 6th.

Institution of Naval Architects, noon. Annual Report of the Council. Address by the President. "On the Influence of the Suez Canal on Ocean Navigation," by J. D'Aguilar Samuda, Esq., M.P. "The Channel Passage—Vessels and Piers," by Vice-Admiral Sir Edward Belcher, K.C.B. "International Communication by Railway Steamships," by John Scott Russell, Esq., F.R.S.
Society of Arts, 8 p.m.
Pharmaceutical Society, 8 p.m.
Royal Society of Literature, 4.15 p.m.
Obstetrical Society, 8 p.m.
Belfast United Natural History Societies, 8 p.m. "Illustrations of the Diffusion of Liquids," by Prof. James Thomson, LL.D., C.E. "The Aquarium," by Dr. Henry Burden. The Members of the Naturalists' Field Club are reminded that the Annual Meeting will be held on April 13th. Intending competitors for the Prizes offered by the Club, should have their collections at the Museum, on or before April 9th.

THURSDAY, 7th.

Royal Society, 8.30 p.m. "On Supra-Annual Cycles of Temperature in the Earth's Surface-crust," by Prof. C. Piazzi Smyth, F.R.S. "On Researches in Animal Electricity," by Dr. C. B. Radcliffe.
Society of Antiquaries, 8.30 p.m.
Chemical Society, 8 p.m. "On the Combinations of Carbonic Acid with Ammonia and Water," by Dr. Divers. "On the Analysis of Deep-sea Water," by Dr. John Hunter. "On the Refractive Equivalents of the Aromatic Hydrocarbons, and their Derivatives," by Dr. J. H. Gladstone. "On an Acid Feedwater from the Coalfields of Stellarton, U.S., and the Results of its Use," by Prof. How.
Royal Society Club, 6 p.m.
Society of Artists and Amateurs, 8 p.m.
London Institution, 7·30 p.m.
Linnean Society, 8 p.m. "On New Species of Annelida," by Dr. Baird. "On Algæ from the North Atlantic Ocean," by Dr. Dickie.
Social Science Association, 4 p.m. (at St. James's Hall). "On the Education of the Blind Sons of Gentlemen, in connection with the Worcester Proprietary College."
Royal Institution, 3 p.m. "Chemistry of Vegetable Products," by Prof. Odling, F.R.S.
Perthshire Society of Natural Science, 8.30 p.m. "On the Falconidæ of Perthshire." "On the Mollusca of the Ponds of the District."
Harveian Society, 8 p.m. "On Lithotomy," by Mr. T. Carr Jackson.
Institution of Naval Architects, noon. "On the Load-draught of Merchant Ships," by W. W. Rundell, Esq. "The Fleet of the Future," by John Scott Russell, Esq. "On Naval Armaments," by Capt. R. A. E. Scott, R.N. "Description of a Sea-going Ironclad Ship of War," by Ralph Dawson, Esq.—7 p.m. "The Experiments recently proposed on the Resistance of Ships," by C. W. Merrifield, Esq. "On certain Theorems connected with the Geometry of Ships," by M. Emile Leclert. "On the Position of the Centre of Gravity of a Ship and its Relation to Stability," by Charles F. Henwood, Esq. "The Influence of Pressure on the Sides of Ships, under certain circumstances," by Charles Lamport, Esq.

FRIDAY, 8th.

Astronomical Society, 8 p.m.
Philological Society, 8.15 p.m.
Royal Institution, 3 p.m. "Pedigree of the Horse," by Prof. Huxley, F.R.S
Quekett Microscopical Club, 8 p.m.
Clinical Society, 8.30 p.m.
Institution of Naval Architects, noon. "On the Law of Resistance of Armour Plates composed of one or more thicknesses," by Sir W. Fairbairn, Bart., LL.D., F.R.S. "On the Treatment of Iron Masts by Sailors of the Merchant Service," by William Symington, Esq. "On Bulkheads," by Laurence Hill, Esq. "The Navigable Dock," by Vice-Admiral Sir Edward Belcher, K.C.B. "On Compound Marine Engines," by Arthur Rigg, Jun., Esq.—7 p.m. "On a Simple Plan of Applying Zinc in a Fluid State to the Surface of Ships," by Charles Lamport, Esq. "On the Present State of the Liquid (or Condensed) Fuel Question," by Capt. J. H. Selwyn, R.N.

SATURDAY, 9th.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. "On the Sun," by Mr. Lockyer, F.R.S.
Institution of Naval Architects, noon. "On the Small Fastenings of Wooden Ships," by William Poole King, Esq. "On a Mechanical Method of Lifting Screw Propellers," by Capt. Symonds, R.N. "On a New Kind of Balanced Rudder," by C. G. Gumiel, Esq. "On Balanced Steering Gear," by Vice-Admiral Sir Edward Belcher, K.C.B.

SUNDAY, 10th.

Sunday Lecture Society, St. George's Hall, 4.30 p.m. "On Witchcraft and the Lessons we learn from it," by Rev. Allen D. Graham, M.A. Oxon.

MONDAY, 11th.

Royal Geographical Society, 8.30 p.m.
Society of British Architects, 8 p.m.
Medical Society of London, 8 p.m.
London Institution, 3 p.m.

TUESDAY, 12th.

Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m.
Ethnological Society, 8 p.m. "On the Danish Element in the Population of Cleveland, Yorkshire," by the Rev. J. C. Atkinson. "On the Ancient Tribal System of Ireland," by H. M. Westropp, Esq. "On the Brain in the Study of Ethnology," by Dr. Donovan.
Photographic Society, 8 p.m.

WEDNESDAY, 13th.

Geological Society, 8 p.m. "On the Fossil Remains of Mammals found in China," by Prof. Owen, F.R.S., F.G.S. "Further Discovery of the Fossil Elephants of Malta," by Dr. A. A. Caruana; communicated by Dr. A. Leith Adams, F.G.S. "Brief preliminary Notes on a large Coal-measure Reptile from the Low Main Coal Shale," by T. P. Barkas, Esq., F.G.S.
Graphic Society, 8 p.m.
Microscopical Society, 8 p.m.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.

LUNAR MAP.—"W. R. B."—We shall be glad to receive the circular when ready. It will enable us to judge, as you say. We have reproduced one or two of the facts communicated to us.

THE FORMATION OF DEW.—"H. H."—The MS. has reached us, and shall appear in due course. We think you hardly deal fairly with Wells; that is to say, that you do not give him credit for all he deserves.

SOLAR SPOTS.—"A. E. S."—A very large one is now traversing the disk. The communication appears.

SIR W. THOMSON AND GEOLOGY.—"A. P."—We cannot insert the letter. We have already had quite enough of the subject, and are merely continuing the correspondence to enable Mr. Menteath to justify his position. Besides, your letter is too long. Those who have communications to make to us, should remember how much matter presses each week upon our pages, and should state their opinions in moderate compass.

LECLANCHÉ CELL.—"S. L. T."—We quite agree with you. The opinion we arrived at is quite the same as yours. The battery seems an excellent and constant and cheap one, but its manufacturers do not take any trouble to make it known to our readers. We have had several letters about it, in regard to its price, &c., but we cannot, nor is it our duty to, reply to them. If manufacturers do not see their own interests, it is no affair of ours.

FOSSILS OF NORTH STAFFORD LIMESTONE.—"T. W."—Thank you for the very excellent printed list of the fossils of this deposit. It is most creditable both to Mr. Carrington, and to the North Stafford Field Naturalists' Club.

EAST KENT NATURAL HISTORY SOCIETY.—Report is in type, but is delayed by press of matter.

FIRING UNDER WATER.—"C.O.H.S." did not state the source from which the account is taken, nor did he send the blocks. If he will favour us with the latter, of good size, we shall be happy to afford him space to describe his invention himself. This will be better than a second-hand quotation.

EAR COUGH.—"C. F."—The subject is of great interest; but, unfortunately, not suited to our pages.

AGRICULTURAL COLLEGE, CIRENCESTER. Our correspondent need be in no way alarmed. The former article to which he refers was written by a gentleman having no interest whatever in the matter, and who never even saw the gentleman referred to. The second statement was merely relative. We shall be happy to do anything in our power for the Institution.

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, U.S.—"R. B."—We are much obliged to you. We shall be glad to assist your museum in any way in our power, by publishing lists of species required, or intelligence of any kind which the authorities may wish to have widely disseminated.

WEDNESDAY, APRIL 13, 1870.

SIR JOHN LUBBOCK ON MILITARY SCIENCE.

SIR JOHN LUBBOCK'S motion in the House of Commons, on Friday night last, is a very apt illustration of the necessity which exists for the thorough representation of Science in Parliament, and also of the fact that, able and energetic as are those few scientific men who now have seats at Westminster, their efforts are overpowered by the time-honoured and ridiculous prejudices of the public mind. Clear and straightforward as was Sir John's mode of proposing his motion regarding the recommendations of the recent Military Education Commission, and eloquently and philosophically as he was supported by Dr. Lyon Playfair, it must have been evident to him that he was really leading a "forlorn hope." It was Sir John Lubbock's arduous and somewhat thankless task to explain to the House that the Commission, like the old French Academy's crab, has been moving backwards as regards the opinion of those whom Mr. Matthew Arnold we suppose would call people of "culture." And he had also to show that such a retrograde step on the part of the authorities was one in the highest degree detrimental to the best interests of the English army. He stated the case lucidly, and he illustrated his remarks by some amusing facts which did not speak favourably for the scientific status of our army.

But those who knew the temper of the House of Commons could see almost from the beginning that the attempt which the hon. baronet made was merely so much loss of words. They who knew the length of the muster-roll of hon. and gallant members foresaw with some pain that the motion would be ultimately shelved, and shelved it most unquestionably was, and we must say in the most unfair and unreasonable manner, and through the sheer force of numbers, not of *νους*. The thing is almost inconceivable, occurring in what we are pleased to style our "Reformed Parliament." Science, save in the examination for the Artillery and Engineer services, has, we may almost say, never been recognized by the military authorities. What little has been done has been more nominal than real, and yet the Military Education Commission has actually had the audacity to reduce the marks previously given to Natural Science in the examination for direct commissions. No rational explanation of this alteration has been given, save that the Commission consisted of military men, who had nothing (very naturally) to say for Science, and of non-combatants, if we may so term them, whose idea of soldierly knowledge began, continued, and ended in the "Humanities." And yet, in the face of these facts, intelligently and forcibly brought forward by the member for Maidstone, the matter is allowed to remain just as it was, and our military men are in the future to know less of Science than those of the past. We must say that such a conclusion to the inquiry was not that which we had a right to expect from the present Government; and we would express a hope that ere long the issue will again be raised, and that Sir John Lubbock will take up the question on a wider basis, and unite his efforts with those of that party who will, we doubt not, eventually do away altogether with the purchase of commissions. For this question of purchase we believe to be at the root of the whole evil,—the Government being unable to obtain from the mass of candidates who can buy a commission the knowledge of those branches of Science which are so essential to the carrying on of modern warfare. At present it is a question of riches *versus* intelligence; but the time must come when our British Army will be officered under other and better conditions; and we therefore hope that Sir John Lubbock and Dr. Playfair will take the step we propose, so that in time the military man, as compared with the mere crammed stripling of the past, will be one

> "Who hasn't a tithe of his money,
> But has certainly ten times his brains."

It is almost waste of words to prove what must be so self-evident after the late American and Austrian campaigns, that the soldier of the future must be a man well skilled in all branches of Science, and that mere bull-dog daring will not carry the field in which the next European battle will be fought. The generalship which so successfully conducted the terrible undertaking against Magdala is ample testimony to this view of the matter; for had not the expedition been superintended by one who fully realized the advantage of scientific methods, the destruction of our soldiery would have been something compared with which the Kyber Pass business would have sunk into insignificance. But it will take another Reform Bill and the introduction of the ballot to drive this simple fact into the heads of gallant members of the House of Commons. And we fear that for some time to come we shall still be treated to those bursts of patriotic bunkum with which Mr. Cardwell treated the House on Friday. It will take an age to remove the stereotyped notion that the British soldier's pluck is equal to any emergency, and that he is certainly a match for at least three Johnny Crapauds, and for no end of Dutchmen; and we fear that Ministers who want to curry favour with the House or the country will still for some time obstruct advanced legislation by appealing to the "distinguishing characteristic of the British soldier."

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

THE visitors called to consider the charges of Mr. Melville against the authorities of Queen's College, Galway, have decided that Mr. Melville was wrong in writing letters to a newspaper without having first laid his complaints before the College Council, but that a three-years' rustication is too severe a punishment for his offence, and ought to be reduced to a term of one year, and further, that he ought also to get the certificates to which he is entitled from the College. We have not seen the evidence on which the visitors passed their judgment, but there can be no doubt that they have acted impartially. It would, of course, be difficult, after the summary treatment which Mr. Melville received, for him to get other students to come forward and support his statements, admitting these to be well founded. But he should have thought of that, and not made charges unless he felt assured that he could substantiate them. The institution he has attacked is in many respects pre-eminently an admirable one, and one which ought not to suffer in public estimation by the charges so rashly made by Mr. Melville. Still, we shall certainly be glad to find that the College authorities have produced evidence to show the actual efficiency of that department of the College which has been so strongly complained of, and have not merely contented themselves with showing that Mr. Melville cannot substantiate his charges before a judicial body.

IT is a well-known fact in surgery that when air gets into the tissues in consequence of a perforation of the lung by a punctured rib, it does not excite putrefaction or suppuration as it is apt to do when it acts on an external wound. Professor Tyndall, in a letter to the *Times*, connects with this fact his observation, by means of a beam of light, that air expelled from the lungs by a forced expiration contains no floating particles, and considers that together these facts afford a complete

demonstration that germs in the air removable by filtration are the cause of putrefaction and its associated phenomena of animalcule life.

The last number of the *Builder* contains a full description of the design for the first portion of the new buildings for Owen's College, Manchester.

The Royal Danish Society of Science, among other prizes, has offered one for the best essay containing an investigation of the movement of the air in a system of ventilation. The essay may be written in English, French, German, Danish, or Swedish, and must be sent in before October, 1870.

We learn from the *Athenæum* that Professor Huxley's work, *Man's Place in Nature* has been translated into Italian by Professore Pietro Marchi, under the title of *L' Uomo nella Natura.*

A History of British Diatomaceæ, by Dr. Donkin, Lecturer on Forensic Medicine to the University of Durham, is preparing for publication by Mr. van Voorst.

An excellent article on the abuse of mechanics' institutions will be found in last week's *Engineer*, pointing out their uselessness as educational institutions, particularly in scientific subjects.

On Friday, in the House of Lords, Earl de Grey and Ripon laid on the table a Bill on Medical Education, which passed its first reading. In introducing it, Earl de Grey said the object of the measure was to amend the existing law relating to the registration of medical practitioners. There were several bodies empowered to confer licenses upon gentlemen entering upon the medical profession, and these licenses entitled the holders to be placed on the medical register. There were no less than nineteen of these licensing bodies, and it was therefore not to be wondered at that there should exist considerable differences as to the terms under which licentiates were admitted, and as to the nature of the examinations to which they were subjected by these various licensing bodies. It was proposed under the Bill to substitute for the various existing modes of entering the medical profession a single examination board in each of the three kingdoms, and to insure uniformity in the nature and quality of the examinations. With this view the Bill would give power to submit to the Medical Council a scheme for the constitution of the new examining boards, but with the restriction that, if they did not exercise those powers within the time limited in the Bill, the powers would lapse to the General Medical Council, who should themselves propose a scheme. The scheme, when prepared, would then have to be submitted to the Privy Council to receive confirmation before coming into operation under the Bill.

The very low value given to scientific, as compared with classical, attainments in the report of the Military Education Commission on the examinations for commissions in the army, was brought before the House on Friday night by Sir John Lubbock, who moved that it was not desirable to diminish, as recommended, the value hitherto attached to natural and physical science at the examination. The motion was seconded by Dr. Playfair, but was afterwards withdrawn, on the assurance of Mr. Cardwell that he would adopt the best means he could to secure in the candidates the largest amount of training from all sources of knowledge, scientific as well as classical.

Professor Tyndall's lecture on "Dust" is, it is said, being translated into French.

A new ship, the *Edinburgh*, has just been fitted up by Messrs. Lairds for the Telegraph Construction and Maintenance Company. She has three large cable-tanks, two of them being 32 ft. in diameter and 22 ft. deep, and the other 26 ft. in diameter and 20 ft. deep. Under the two largest of them there has been fitted an inner skin, forming a double bottom, for stowage of water-ballast when the weight in the cable-tanks has run out. There are also various other fittings and appliances specially arranged for the telegraph work. The engines, which are new, have been made by Messrs. Laird on the compound system.

The motion that it is desirable that the National Gallery and the British Museum should be open to the public on week-day evenings is to come before the Commons on May 6th.

In consequence of the working arrangements not being in a sufficiently satisfactory condition to content its engineer, the Tower subway has not yet been opened for traffic. According to the *Engineer*, the main difficulty seems to arise from the want of a satisfactory means of communication between the engine-drivers in the shafts and the conductor of the omnibus, so that they may work into each other's hands, and apply the one their clips and the other his brake, as need requires. To this end a more efficient system of signalling seems indispensably necessary, and should include such means of communication as will keep the engine-driver informed as to the positions of the carriage at different stages in its passage through the subway. A short descent at each end for facility in starting, with a long level run in the middle, would have obviated to a great extent the difficulties that are being experienced; in the descent the carriage acquires greater momentum than can be utilized—in fact, the brake has to be applied in running down, and the hitch usually occurs at a short distance from the end of the journey, before the ascent has been completed.

It is suggested by a writer in the *Builder* that had the Tower Subway been made of one uniform tube in the shape of the eighth of a circle, it would have passed well down under the river in the eocene London clay free of the bed materials, and have had its entry and exit only about twelve yards further from the river. The advantage would have been the absence of *shafts, lifts*, and *change of vehicle*. The utmost utilization of gravity as motive power would then also have been made. It is well known that without friction or resistance, the quickest way, or "*Brachystochrone*," from any spot to any other, would be part of a cycloid if the second point be lower than the first, or a whole cycloid if on the same level. Now, if you only cut from a cycloid one-eighth at each extremity, the remaining three-fourths contain practically *no* change of curvature, but so closely approach a *quadrant of a circle* that the finest workman could hardly distinguish them. But the brachystochrone, *allowing for the friction*, is always less curved than the cycloid, and still *more* approximate therefore to a smaller circular arc than this was to a quadrant. Thus it is seen how very near an octant must be the theoretically *very best* subway for economy of power.

The students of the Edinburgh Veterinary College are in rebellion against the professor of anatomy. The Lord Provost and magistrates of Edinburgh, who are trustees of the College, are interfering to settle the dispute.

A brief abstract of Dr. Waldheim's memoir in Pringsheim's *Jahrbuch für wissenschaftliche Botanik*, on the "Biology and Development of the Ustilagineæ," will be found in the current number of the *Gardeners' Chronicle.*

The *British Medical Journal* announces its intention of having an examination made of water-filters. In the report which appeared a few years ago in the *Lancet*, and which was evidently based on carefully-made experiments, the magnetic carbide filters of Mr. Spencer, of Euston-square, were found to be both more efficient than others, and permanent besides in their action. Our own experience of their use goes to confirm this statement.

A student in the chemical laboratory of the Hôtel Dieu has suffered serious injuries through the explosion of some compound or mixture at which he was working. The laboratory was almost destroyed by the explosion.

Another Englishwoman, Miss Morgan, has passed the University of Zurich for the degree of M.D. Miss Morgan is reported to have sustained her theses with very great success.

M. Lallemand has been nominated Professor of Physics to the Poictiers Faculté des Sciences.

According to the *North German Correspondent*, a great Polar expedition is being prepared in Sweden, for the years 1871 and 1872, under the direction of Professor Nordenskjold, the celebrated scientific leader of the Swedish expedition of 1868. Parry's attempt to reach the Pole by pushing on to the north of Spitzbergen is to be repeated, and it is proposed to winter on one of the Seven Islands. Professor Nordenskjold intends to proceed to Greenland this summer to purchase dogs for the sledges and procure some necessary information.

The postage on printed matter is to be reduced to one halfpenny for four ounces, with an additional fraction for any amount above that weight. Newspapers not exceeding six ounces will be carried for a halfpenny. In announcing these reductions, in his speech on the Budget, Mr. Lowe gave £250,000 as the estimated loss to the revenue. We trust he will find he has greatly over-estimated this loss; but, should it be otherwise, we are confident that, as found in other cases, this removal of an impediment to the prompt diffusion of information will prove in the end to be a great pecuniary gain to the country.

Of the superiority of steam-rollers over horse-rollers for macadamizing our roads, few, we should think, can have a doubt, and these few would have their doubts removed by a perusal of Mr. Paget's lecture on the subject, the publication of which is now just concluded in the pages of the *Engineer*. It is very satisfactory to find, however, that the cost of steam-rolling as carried on in Paris is estimated at not more than one half the total cost of horse-rolling. We hope it is true that Mr. Paget's paper is to be reprinted by the Metropolitan Board of Works, and widely circulated among the governing bodies of London.

Apropos of this matter, Professor Huxley, in his lecture at the Royal Institution on the Horse, had on the table as an exhibition of the "Instruments of horse torture employed in the nineteenth century on the roads of the south of London, within the four-mile radius of Charing-cross, April, 1870,"—a number of large razor-edged flint stones, picked up from the roads, some with frightfully jagged edges with most terrific points, and many of them of great size.

Dr. Bence Jones's lectures on Matter and Force have appeared in French.

It is as an acknowledgment of Sir Francis Ronald's early and remarkable labours in telegraphic investigation that he has been knighted, and not, as stated in our last number, on account of his being the original inventor of the electric telegraph, to which distinction he lays no claim.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

ON THE FORMATION OF DEW AND ITS EFFECTS.

BY HENRY HUDSON, M.D.

In Two Parts.—Part I.

After the most careful study of Dr. Wells's theory of dew, I think it necessary, in the interest of scientific truth, to state the grounds on which I believe it must be rejected. I assume the following axioms:—1st. That the earth is a principal source of heat to the atmosphere, and that the normal law of atmospheric temperature is "diminution with increase of elevation;" 2nd. That there is a tendency in heated air to ascend and in colder air to descend vertically; 3rd. That whenever vapour passes to the liquid or solid state there is an evolution of heat.

As regards the last point, I submit that the action which takes place is the *inverse* of what occurs during "evaporation through the action of the atmosphere," which is best explained by considering the "rationale of the wet ball hygrometer," in which a "thin shell of air," having a certain amount of dryness, on coming in contact with the wet and dry bulbs (both *initially* at same temperature), has no effect upon the latter, but causes the evaporation of some water from the former, whereby its temperature is reduced, and the air, thus rendered more damp, is removed, being replaced by "a similar shell" of the external atmosphere; this process goes on until the temperature of the wet bulb becomes stationary. The attainment of this fixed point may be accelerated by a more rapid removal of the air which abstracts the moisture, but the actual temperature ultimately arrived at is essentially the same. Hence it is assumed that this "shell of air," when the temperature is stationary, contributes to the wet bulb (in falling from the temperature of the dry bulb) precisely that amount of heat which is required to vaporize so much moisture as was wanting to "saturate" the shell of air which communicated its heat; or, in fact, that "the reduction of the air's temperature is a measure of the latent heat of the vapour which is formed." I have dwelt on this point, inasmuch as I was once told by a "professor," who, as I imagined, ought to have understood the "rationale of the process," that "the capacity of air for heat—*by volume*—had nothing to say to the theory of the wet ball hygrometer!"

In the action just described the air has been cooled by the evaporation of water; on the other hand, when dew is formed the *air* must be warmed by the latent heat of the condensed vapour. The water which is deposited must have the same temperature as the moist air had previously, and the heat given out must be carried upwards by the air which has surrendered this moisture.

When the sun has ceased to act in any locality, a vertical descent of the cold upper air and a corresponding ascent of the warmer air at the surface must take place (if no disturbing cause interfere), and this interchange necessarily tends to equalize the distribution of heat in the lower strata of the atmosphere. If, then, the sky be cloudless and the air calm, it is to be expected, in our moist climate, that this decline of temperature will approximate to the dew-point; when moisture is deposited, the air, warmed by the latent heat of the water, ascends, and (as the same process goes on—not merely at the surface but—*in every stratum of the atmosphere where vapour is condensed*) we discern an obvious cause for an "increase of heat-development (as we ascend) to a distance somewhat beyond that height at which condensation of moisture ceases to take place," producing a reversal of the normal law and presenting the unexpected phenomenon of "increase of temperature with increase of elevation above the surface."

The Reports to the British Association of Mr. Glaisher's Balloon Ascents furnish the strongest experimental evidence of the correctness of these views. Thus, in his first ascent (vol. for 1862, p. 444), Mr. Glaisher remarks, "In this *ascent . . . . below the cloud* the decrease of temperature was pretty uniform; on passing out of it there was an increase of 6°, and then decrease was resumed." On the 18th August, 1862, from notes 10 and 11, p. 394, we find "the balloon was in *clouds* between 3,000 ft. and 4,000 ft. above surface," and (p. 445) "the temperature of the air decreased as usual on leaving the earth, until *at the height of* 4,000 ft. (therefore *above* the cloud) the rapidity of the decrease was arrested." It may be observed that on both these occasions the "change occurred *above* the cloud." Mr. G., however, mentions a "warm current" as accounting for it.

On the *evening* of the 20th August, 1862 (p. 381), Mr. Glaisher writes, "at 7.47 p.m. a height of one mile had been reached, and the temperature was 45°, dew-point 42°; it was very dark below, but there was a clear sky above. . . . . We ascended *till the clouds were below us*, the temperature had fallen to 43°; we were soon enveloped in fog again. . . . . At 8.5 *we were quite above the clouds . . . . the temperature had increased to* 55° at a height of 7,400 ft.

On the 21st August, 1862 (p. 382), "at 5.10 a.m. a height of 8,000 ft. had been attained, and the temperature had increased from 38¼° *in the cloud* to 41°." Also (p. 447), "the sky was cloudy, and the decrease of temperature nearly uniform *till the clouds were reached;* on passing through them the *usual* increase of temperature took place to the amount of about 5°." On September 1st (p. 447), Mr. Glaisher says, "the sky was covered with cirrostratus clouds, *which were never reached;* there was *no* marked interruption in the regular decrease of temperature, either in the ascent or descent." In his remarks on ascent, 5th September, 1862 (p. 448), we read,—"In this ascent on passing out of the clouds there was an increase of 9°." September 8th, 1862 (p. 449), "the sky was cloudy, decrease of temperature nearly uniform."

In volume for 1863 (p. 427), ascent, 31st March:—"The sky was blue and almost cloudless; . . . . almost every successive reading of the thermometer was less than the preceding in ascending and greater in descending; . . . . the temperature was just zero at the highest point (22,884 ft.) and 42° on the ground; there had therefore been on the earth a decline of 8° during the 2h. 10m. we were away. By comparing the temperatures on the same level it will be seen that all those when descending are *lower* than those ascending, indicating that the *whole mass of air was declining in temperature* as that in immediate contact with the earth, though possibly to a less degree."

18th April, 1863 (p. 428):—"At 1.26 we were 7,000 ft. high, in a thick mist, almost a fog; the temperature of air continued at 32° nearly, whilst that of the dew-point increased several degrees; on *passing out of the cloud* these two temperatures very suddenly separated, the latter decreasing rapidly; the sky was without a cloud."

21st July, 1863 (table, p. 470), we find:—"At 5.42 p.m., at height of 636 ft., the temperature of the air was 61·5°; there was *no change* in descending to the earth, when (at 5.45) it was still 61·5°."

Volume for 1864 (p. 222), 13th June, 1864, we find in table at 2.41.30, height 6,550 ft. (marked in note "cloudy"), the temperature 29·5°; at 2.50, height 7,277 ft., the temperature had risen to 31°." Mr. Glaisher remarks on his *last descent*:—"The temperature (7.58 p.m.) at 1,800 ft. was 53·2°, below which there was scarcely any change till the earth was reached (at 8.14 p.m.). This fact, of no change in the temperature of the air within 1,800 ft. of the ground at the time of sunset, was very remarkable, for it indicated that if such be a law, the law of decrease of temperature with increase of elevation *may be reversed at night for some distance from the earth.*"

In ascent, 20th June, 1864 (p. 271, and table, p. 236):—"About 6.15 p.m., temperature at ground before starting was 66·5°; . . . . at 4,200 ft. (6.53), temperature was 49·5°; on descending for the last time it increased to 61° at 2,000 ft., and to 64·5° on the ground. This was about one hour before sunset, showing in the last 2,000 ft. an increase of temperature of 3°, thus showing that the *usual law holds good to this time*, but apparently with *far less energy*, as, *in ascending*, the decrease of temperature, in the same space, was *three times greater*, or 9°."

Volume for 1865, 30th Dec., 1864 (p. 147):—"At 2,500 ft. we met with clouds. The temperature was 31° at 3,300 ft., just *at the upper surface* of the cloud the temperature was 27°; on getting *above the cloud* the temperature rose, and, when 400 ft. above it, had increased to 31·5°." Again, in the final descent at about 3 p.m., "at 900 ft., the temperature was 38·5°, no change at 300 ft., and the same at the surface."

27th Feb., 1865 (p. 147):—"We left the earth at 1.58 p.m. The temperature of the air was 52°, declined gradually to 35° (2.6 at height of 3,990 ft.), when cloud was reached. . . . . During the passage through it there was no change of temperature, but on passing *above it*, the temperature increased with the elevation." At 2.17 p.m. (height being 4,965 ft.—see table p. 160), the temperature was 39·2, showing above 4° of increase *above the cloud.*

Volume for 1866 (p. 368):—On 2nd October, 1865, "at 6.20 p.m., temperature at the time being 56° (about three-quarters of an hour before sunset), the ascent commenced, the *sky free from cloud;* at 6.25 p.m., height 967 ft., temperature 57° and increasing; at 1,200 ft. it had increased to 58·9°. On descending to 900 ft., temperature fell to 57·8°. On again ascending, the temperature increased to 59·6° at 1,900 ft., being 3·5° *warmer* than when the earth was left. On descending, the temperature decreased to 57·5° at the height of 600 ft.; and in the several subsequent ascents and descents, the temperature increased with elevation and decreased on approaching the earth. On every occasion the highest temperature was met with at the highest point." As regards the humidity of the air, he says, "Its amount of moisture in the beginning of the ascent was 5¼ grains in a cubic foot of air; and, at the same elevation, was 4½ grains in the same mass of the air at the end of the ascent." This, in accordance with my views, accounts for the observations, inasmuch as ¾ of a grain of moisture liquefied will heat a cubic foot of air about 6°. Again (p. 370), Mr. Glaisher says, "This first night-experiment, so far, indicates that, on a clear night, the temperature up to a certain elevation increases with increase of elevation."

2nd December, 1865 (p. 370):—"The day was cloudless, but became suddenly overcast before the ascent. At about 2½ hours after sunset, left the earth (temperature being 38¼°); at 1,400 ft. it was 2° lower. All through this excursion the temperature fell with increase of elevation. During the whole ascent the sky was *covered with cloud*" (p. 371). "The experiments all show a *small decrease* of temperature with increasing elevation; they were made, however, entirely *under the cloud.*"

29th May, 1866 (p. 371):—"At 6.14 p.m. (about 1¼ hour before sunset), temperature of air 58°; at 1,200 ft., temperature 55°; between 3,600 and 4,600 ft. temperature was 43°; and at height of 6,200 ft. (at 7·17) temperature was 29½°. On descending, the temperature increased, but not uniformly, to 54° (8.9) at 380 ft. above the sea—the sun had set previously. On ascending again the temperature declined, but somewhat *less rapidly* than before. At one mile the temperature had declined to 39°; and on reaching the height of 6,200 ft.—the sun having set nearly 20 minutes—the temperature was 35°, or about 6° *warmer* than when at the same elevation something more than one hour before. On descending there was little change for 1,000 ft.; temperature increased to 37° at 4,500 ft.; to 47° at 1,500 ft.; and to 54° at 900 ft.; but here the increase was checked, and at 600 ft. the temperature was 52¼°. On ascending a little again the temperature increased, and decreased on descending, and was 50½° on the ground at a spot 300 ft. above the sea at half-past 8 o'clock.

Mr. Glaisher's remarks on these night ascents are (p. 373):—"About sunset, the temperature varies little for a height of 2,000 ft.; at night, *with a clear sky*, from the only experiment made, the temperature *increases with increase of elevation; with a cloudy sky*, there was a small increase of temperature as the height increased. In the double ascent, on the 29th May—the one just before sunset and the other after—*it would seem* that after radiation is set in, the heat passes upwards till arrested where the *air is saturated with vapour*, when a heat greater by 5 degrees was experienced after sunset than at the same elevation before sunset."

I have only a few observations to offer on these experi-

ments—1st. That, in every instance, they show "increase of temperature above the clouds," *i.e.*, "where vapour is condensed." 2nd. The night ascent of the 2nd October, 1865, distinctly proves "an increase of temperature as we ascend *in clear calm weather* when condensation takes place." 3rd. The ascent on 31st March, 1863, is equally conclusive in proving that with a *blue and almost cloudless sky* there will be no *inversion* of the normal law *provided the air be very dry*; for, on this occasion, "the dew-point just before reaching the earth was 12½° below the atmospheric temperature, and was even much farther removed at the higher elevations." Hence there was *no condensation* of vapour, and the normal law was not subverted at all during this ascent. (See table, pp. 438-9 of vol. for 1863, as to the above.) 4th. That the phenomenon requiring explanation *on dewy nights* in these experiments, as well as in all those of Dr. Wells, is "an increase of temperature in ascending from the earth," and not *merely* a "chilled surface in reference to the air generally." 5th. That there is an *increase* of atmospheric temperature (when dew is formed) above that which existed previously, the surface only sharing the cold temperature of the deposited moisture, and being really *protected* from any excessive chill from the "etherial vault," by the heat which the air receives from the condensed vapour. As a proof of this point I would refer especially to the "increase of nearly 6° in the temperature (at the height of 6,200 ft.) *after sunset*" in Mr. Glaisher's ascent, 29th May, 1866.

In regard to Dr. Wells's theory, if we assume "terrestrial radiation" as a cause, it is evident that the *maximum* absorption of heat must occur in the *lowest* stratum of air, and this cause could not therefore in any way contribute to *greater heat* at higher elevations. Many of Dr. Wells's assumptions are plainly inadmissible; for instance (Casella's edition, p. 68), "That dense clouds near the earth must possess the same heat as the lower atmosphere" (also p. 69). "That terrestrial heat *must have* a ready transit through an atmosphere which *transmits solar heat* copiously" (also pp. 64 and 78). He assumes "that the superficial stratum of air proceeds to radiate back to the earth its excess of heat" (acquired by radiation *from* the earth), and that *it* is thereby more chilled than the superior strata"—apparently forgetting that if it radiated to the earth it must do so also to the upper strata, which (in like manner) must be taken as radiating upwards and downwards. His hypothesis is therefore utterly worthless for the purpose of explaining the phenomena. The chilling effect of air descending from the upper regions appears to be nearly altogether ignored by Dr. Wells; and he assumes (p. 67) "that clouds act as *radiators of heat* to the earth," instead of merely "screening it" from extreme chilling "etherial" influences (in a manner similar to the "raised board" in his own experiments); and yet he admits that (p. 29), "During nights *generally clear*, if the *zenith* be occupied by a cloud *for only a few minutes*, a thermometer on the grass will rise several degrees." A cloud in the zenith may act as a screen, and produce such a result; but *its* influence cannot be attributed to "radiation of heat to the thermometer." It merely *interferes* to diminish the chill from above, and enables the heat of the earth to regain its ascendency in warming the surface.

ON THE TEMPERATURE AND ANIMAL LIFE OF THE DEEP SEA.

BY WILLIAM B. CARPENTER, M.D., F.R.S.

IN FOUR PARTS.—PART IV.

DURING each cruise of the *Porcupine* samples of sea-water, obtained from various depths as well as from the surface, at stations far removed from land, were submitted to the permanganate test, after the method of Professor W. A. Miller, with an addition suggested by Dr. Angus Smith for the purpose of distinguishing the organic matter *in a state of decomposition* from that which is only *decomposable*; with the result of showing the uniform presence of an appreciable quantity of matter of the latter kind, which, not having passed into a state of decomposition, may be *assimilable* as food by animals, being, in fact, Protoplasm in a state of extreme dilution. And the careful analyses of larger quantities collected during the third cruise, which have been since made by Dr. Frankland, have fully confirmed these results by demonstrating the *highly azotized* character of this organic matter, which presents itself in samples of sea-water taken up at from 500 to 750 fathoms' depth, in such a proportion that its universal diffusion through the oceanic waters may be safely predicated.

Until, therefore, any other more probable hypothesis shall have been proposed, the sustenance of animal life on the ocean-bottom at any depth may be fairly accounted for on the supposition of Professor Wyville Thomson, that the Protozoic portion of that Fauna is nourished by direct absorption from the dilute Protoplasm diffused through the whole mass of oceanic waters, just as it draws from the same mass the mineral ingredients of the skeletons it forms. This diffused Protoplasm, however, must be continually undergoing decomposition, and must be as continually renewed; and the source of that renewal must lie in the *surface-life* of plants and animals, by which (as pointed out by Professor Wyville Thomson) fresh supplies of organic matter must be continually imparted to the oceanic waters, being carried down even to their greatest depths by that *liquid diffusion* which was so admirably investigated by the late Professor Graham.

Not only, however, has the nutrition of the abyssal Fauna to be explained; its *respiration* also has to be accounted for; and on this process also the results of the analyses of the gases of the sea-water made during the *Porcupine* expedition throw very important light. Samples were collected not only at the surface, under a great variety of circumstances, but also from great depths; and the gases expelled by boiling were subjected to analysis according to the method of Professor W. A. Miller—the adaptation of his apparatus to the exigencies of ship-board having been successfully accomplished during the first cruise by Mr. W. L. Carpenter. The general average of thirty analyses of surface-water gives the following as the percentage proportions:—25·1 oxygen, 54·2 nitrogen, 20·7 carbonic acid. This proportion, however, was subject to great variations, as will be presently shown. As a general rule, the proportion of oxygen was found to diminish, and that of carbonic acid to increase, with the depth: the results of the analyses of *intermediate* waters giving a percentage of 22·0 oxygen, 52·8 nitrogen, and 26·2 carbonic acid; whilst the results of analyses of *bottom*-waters gave 19·5 oxygen, 52·6 nitrogen, and 27·9 carbonic acid. But *bottom*-water at a comparatively small depth often contained as much carbonic acid and as little oxygen as *intermediate* water at much greater depths; and the proportion of carbonic acid to oxygen in *bottom*-water was found to bear a much closer relation to the abundance of animal life (especially of the more elevated types), as shown by the dredge, than to its depth. This was very strikingly shown in an instance in which analyses were made of the gases contained in samples of water collected at every 50 fathoms, from 400 fathoms to the bottom at 862 fathoms, the percentage results being as follows:—

	750 fath.	800 fath.	Bottom, 862 fath.
Oxygen	18·8	17·8	17·2
Nitrogen	49·3	48·5	34·5
Carbonic Acid	31·9	33·7	48·3

The extraordinarily augmented percentage of carbonic acid in the stratum of water here immediately overlying the sea-bed was accompanied by a great abundance of animal life. On the other hand, the lowest percentage of carbonic acid found in bottom water—viz. 7·9—was accompanied by a "very bad haul." In several cases in which the depths were nearly the same, the analyst ventured a prediction as to the abundance, or

otherwise, of animal life, from the proportion of carbonic acid in the bottom-water; and his prediction proved in every instance correct.

It would appear, therefore, that the increase in the proportion of carbonic acid, and the diminution in that of the oxygen, in the abyssal waters of the ocean, is due to the respiratory process, which is no less a necessary condition of the existence of animal life on the sea-bed, than is the presence of food-material for its sustenance. And it is further obvious that the continued consumption of oxygen and liberation of carbonic acid would soon render the stratum of water immediately above the bottom completely irrespirable—in the absence of any antagonistic process of vegetation—were it not for the upward diffusion of the carbonic acid through the intermediate waters *to the surface*, and the *downward* diffusion of oxygen *from* the surface to the depths below. A continual interchange will take place *at* the surface between the gases of the sea-water and those of the atmosphere; and thus the respiration of the abyssal Fauna is provided for by a process of diffusion, which may have to operate through *three miles* or more of intervening water.

The varying proportions of carbonic acid and oxygen in the *surface*-waters are doubtless to be accounted for in part by the differences in the amount and character of the animal life existing beneath; but a comparison of the results of the analyses made during the agitation of the surface by wind, with those made in calm weather, showed so decided a reduction in the proportion of carbonic acid, with an increase in that of oxygen, under the former condition, as almost unequivocally to indicate that superficial disturbance of the sea by atmospheric movement is absolutely necessary for its purification from the noxious effects of animal decomposition. Of this view a most unexpected and remarkable confirmation has been afforded by the following circumstance:—In one of the analyses of surface-water made during the second cruise, the percentage of carbonic acid fell as low as 3·3, while that of oxygen rose as high as 37·1; and in a like analysis made during the third cruise, the percentage of carbonic acid was 5·6, while that of oxygen was 45·3. As the results of every other analysis of surface-water were in marked contrast to these, it became a question whether they should not be thrown out as erroneous; until it was recollected that, whilst the samples of surface-water had been generally taken up from the *bow* of the vessel, they had been drawn in these two instances from *abaft the paddles*, and had thus been subjected to such a violent agitation in contact with the atmosphere as would pre-eminently favour their thorough aëration.

Hence, then, it may be affirmed that every disturbance of the ocean-surface by atmospheric movement, from the gentlest ripple to the most tremendous storm-wave, contributes, in proportion to its amount, to the maintenance of animal life in its abyssal depths—doing, in fact, for the aëration of the fluids of their inhabitants, just what is done by the heaving and falling of the walls of our own chest for the aëration of the blood which courses through our lungs. A perpetual calm would be as fatal to their continued existence as the forcible stoppage of all respiratory movement would be to our own. And thus universal stagnation would become universal death.

Thus it has been shown that the bed of the deep sea, even in the immediate neighbourhood of our own shores, is an area of which the conditions have until lately been as completely unknown as those of the ice-bound regions of the poles, or of the densest forests, the most arid deserts, the most inaccessible mountain-summits, that lie between the tropics; and further, that by the systematic employment of the sounding apparatus, the thermometer, and the dredge, almost as complete a knowledge can be gained of those conditions as if the explorer could himself visit the abyssal depths he desires to examine. Of the important discoveries in almost every department of science, but more particularly in what Mr. Kingsley has well termed bio-geology, which may be anticipated from the continuation and extension of an inquiry of which the mere commencement has yielded such an abundant harvest, the speaker felt it scarcely possible to form too high an expectation. And, in conclusion, he referred to the systematic and energetic prosecution of deep-sea explorations by the United States Coast Survey and by the Swedish Government—the results of which prove to be singularly accordant with those now briefly expounded—as showing that other maritime Powers are strongly interested in the subject; and expressed the earnest hope that the liberal assistance of her Majesty's Government, which has already enabled British naturalists to obtain the lead in this inquiry, would be so continued as to enable them to keep it in the future. In particular, he called attention to the suggestion lately thrown out by M. Alex. Agassiz, that an arrangement might be made by our own Admiralty with the naval authorities of the United States, by which a thorough survey, physical and biological, of the North Atlantic should be divided between the two countries; so that British and American explorers, prosecuting in a spirit of generous rivalry labours most important to the science of the future, might meet and shake hands on the mid-ocean.—*Lecture delivered before the Royal Institution.*

WHAT WAS DONE IN THE SEVERAL BRITISH OBSERVATORIES IN 1869.

In Four Parts.—Part IV.

Mr. Lassell's Observatory.

MR. LASSELL remarks that since his return from Malta he has almost entirely neglected astronomy; but he has at length re-erected his 2-ft. equatorial, nearly as it was at Starfield, and at Bradstones. He has chosen the form of a drum-dome, as possessing *greater* permanence of shape: and therefore affording *greater facility* of opening and shutting, without danger of the shutters being set fast by increased or unequal friction by warping. Mr. Lassell thinks that the greater capacity of the building is also advantageous, by its securing a more uniform temperature. The dome revolves on six 8-in. cannon balls, working between cast-iron channels, the sectional curvature of which is 6 in. radius. The lower channel is screwed to a ring consisting of two strata of inch and a half deal plank, 11 in. broad, cut into lengths of 3 ft. 6 in., and bolted together with the end joints alternating. This ring is secured by ½-in. bolts, built in the brickwork, to a 9-in. circular wall, whose interior radius is 14 ft. 6 in. The upper channel is screwed to the under surface of a similarly constructed ring, of pieces of plank 3 in. thick. This forms the base ring of the dome, on which are supported three other lighter rings by intervening crosses, these lighter rings and crosses being respectively made out of 1 in. and 1¼ in plank. Across the circle of the uppermost ring, but 2 ft. 6 in from its centre, is laid a trussed beam, 29 ft. 8 in. long, which carries the side-supports of the horizontal shutter, distant 4 ft. 8 in., and extending quite across the building. This shutter, about 18 ft. long, travels on rollers between these supports, and when withdrawn, exposes the vertical sky from the circumference of the dome to 2 ft. 6 in. beyond the centre. The roof, principally borne by the trussed beam, and having no more inclination than is necessary for carrying off the rain, is covered (as well as the circumference of the dome) with ⅜ in. deal board in two strata, which finally received a coat of well-painted canvas. The vertical shutter is framed of wood to the radius of the building, travelling on two large pulleys guided by a rail, and when opened, slides within that part of the dome which is adjacent to the opening on the preceding side, so as to be completely out of the way, and unaffected by wind, however violent.

The mode of carrying on the dome while observing, is by attaching a light pair of three-sheave blocks to the wall-plate and base-ring, the end of the rope, or fall being carried to a hook or belaying-pin attached to the observing staircase. The

facilities for opening and closing the dome are by this construction eminently satisfactory, either operation being performed *in less than one minute*, without any irksome exercise of muscular power.

Mr. Lassell has also introduced a slight variation in the *mounting* of the telescope, having substituted a cast-iron frame for the mass of masonry which formerly supported the upper part of the polar axis; which renders the instrument more capable of removal, should that ever be required.

He is glad to say that the condition of the telescope on this remounting gives him the greatest satisfaction. The speculum has been laid up under a coat of varnish for more than eight years; yet on this being carefully dissolved off with a little absolute alcohol, the surface reappears with no sensible deterioration of either lustre or defining power; and Mr. Lassell sees minute points of light and the surface of Jupiter (barring a little abatement of his own visual acuteness) just as well as ever. He is inclined to think this size of telescope the very best in point of efficiency that can be, since it is just within the power of one observer to manage it, without being dependent on an assistant.

Mr. Lassell is afraid that he cannot promise for the future to be a very active observer; and during the few opportunities he has yet had, he has been most struck with the phase of Jupiter, which presents this year an aspect more distinguished by a profusion of narrow sharp belts, together with on the whole a more uniform aspect from day to day and from week to week, than used formerly to be present. On reference to a pretty numerous series of sketches of the planet which Mr. Lassell has made during more than twenty years, he is struck with the variety of configuration which has presented itself, without precisely the same form having hitherto recurred. When we reflect upon the magnitude of these colossal changes on the surface of a planet of so vast a size, we cannot help being impressed with a feeling of intense admiration, and of curiosity (if that were of any avail) to know how they are produced.

Mr. Huggins's Observatory.—In the autumn of 1868, numerous experiments were made for the purpose of finding a method by which the forms of the solar prominences could be observed directly. Several new arrangements of the spectroscope were constructed with this object in view, but at last the very simple method of employing a wide slit suggested itself, and on February 13, Mr. Huggins succeeded in this way in observing *directly*, and not by inference, from the varying length of the bright lines, the outline of a solar prominence. When a spectroscope of only moderate power is employed, Mr. Huggins found it to be of advantage to limit the field of view of the little telescope to the part of the spectrum where the light of the prominence is situated, and further to interpose a red glass when the light is found to be inconveniently bright to the eye.[1] Other experiments were carried on for the purpose of rendering the solar prominences visible without a spectroscope, by means of the property of selective absorption possessed by many-coloured media, a method which presented itself to Mr. Huggins three or four years since. The problem to be solved was to find a combination of media which would absorb light of all refrangibilities except precisely that of C, or of F. A large number of mineral and vegetable substances was examined; the most promising combination which has been found consists of a solution of carmine in ammonia which cuts off nearly all the light more refrangible than C, combined with a solution of chlorophyll which gives a band of absorption, taking away the brighter part of the light less refrangible than C. As yet chlorophyll has only been obtained in a state in which the band of absorption encroaches upon C, and weakens the light of the prominence.[2]

The observations in this observatory were interrupted in the autumn by the necessary preparations to fit the building for the reception of a refractor of 15 in. aperture, which is being constructed by Mr. Grubb of Dublin, for the Royal Society, by whom it will be placed in the hands of Mr. Huggins.—*Annual Report of the Council of the Royal Astronomical Society.*

[1] *Proceedings of the Royal Society*, vol. xxvii. p. 302.
[2] *Monthly Notices*, vol. xxx. p. 36.

ON THE COMPOSITION OF THE WATER OF THE IRISH SEA.

BY T. E. THORPE, PH.D., AND E. H. MORTON.

THANKS to the investigations of Forchhammer, Von Bibra, Bischof, and others, our knowledge concerning the nature and distribution of the saline constituents of sea water and of the causes of the variations in its composition as observed in various parts of the world, is tolerably extensive and precise. English chemists, however, have contributed next to nothing to the general stock of our information on this subject. This is not a little remarkable, especially when we consider the peculiarly favourable condition in which this country is placed for researches of this kind, by reason of its insular position. A few observations by John Davy, made in the course of his long voyages; two memoirs by Marcet in the *Philosophical Transactions* for 1819 and 1822, on the temperature and saltness of various seas; and an elaborate analysis by Schweitzer of the water of the English Channel, made in 1838, constitute by far the chief portion of the work done in this direction by English chemists. The chemical history of the sea is mainly to be derived from the researches and observations of chemists, principally French and German, the majority of whom were located at considerable distances from the seaboard, and who laboured therefore under all the disadvantages which this circumstance necessarily entails. So far as we can learn, the water of the Irish Channel has never been analyzed. We have been induced therefore to undertake its analysis in the hope of supplying information respecting the nature and extent of the modifications effected in the composition of the sea by its proximity to our coasts. Accordingly, Captain Temple, of the *Bahama Bank* lightship, kindly collected for us a quantity of the water in the immediate neighbourhood of his vessel. The vessel is situated in lat. 54° 21′ N. and long. 4° 11′ W., seven miles W.N.W. of Ramsay, Isle of Man, and is placed nearly equidistant from the shores of England, Scotland, and Ireland. During the greater part of the day a strong current setting in from the south, probably from the Atlantic, flows past the ship into the North Channel, and thence again into the ocean. The water therefore taken for analysis was originally that of the deep ocean, which had traversed almost the entire length of the Irish Channel, and had consequently been exposed to all the influences due to the neighbouring sea-board, and to the influx of the numerous rivers along the coasts.

The water was obtained in the early part of January, 1870; the meteorological conditions at the time of collection, and for some time previously, were in no wise remarkable. The analysis was commenced immediately on receipt of the water. Its specific gravity compared with distilled water, free from air, and possessing the same temperature, was found to be

At 0° C.	1·02721.
At 15° C.	1·02484.

These numbers differ but slightly from that usually accepted as representing the mean specific gravity of the water of the ocean. The water of the Atlantic, according to Von Horner, possesses the specific gravity 1·02875 at 0° C.; that of the English Channel at 15·5° was found by Schweitzer to be 1·0271; on nearing the land the specific gravity fell to 1·0268.

Full details of the methods of analysis employed are given in the original paper. The following synopsis shows the mean results of the determinations: the numbers express the

amount of the various ingredients in 1,000 grammes of the sea-water :—

1. Chlorine	18 62650
2. Bromine	·06133
3. Sulphuric Acid (SO_4)	2·59280
4. Lime (total)	·57512
5. Calcium Carbonate	·01754
6. Magnesia	2 03233
7. Mixed Alkaline Chlorides	27 18363
8. Potassium	·39131
9. Sodium	10·40200
10. Ferric Oxide	·00465
11. Ammonia	·00011
12. Nitric Acid	·00156
13. Fixed Constituents	33·83855

These substances, arranged on the assumption that the strongest acid is united with the strongest base, yield the following numbers :—

Sodium Chloride	26·43918
Potassium Chloride	·74619
Magnesium Chloride	3·15083
Magnesium Bromide	·07052
Magnesium Sulphate	2·06608
Magnesium Carbonate	traces.
Calcium Sulphate	1·33158
Calcium Carbonate	·04754
Lithium Chloride	traces.
Ammonium Chloride	·00044
Magnesium Nitrate	·00207
Silicic Acid	traces.
Ferrous Carbonate	·00503
	33·85946
Amount directly determined	33·83855

The water employed in the foregoing analysis was collected in midwinter. It becomes interesting to know if its composition is uniform during the various seasons of the year. Fortunately, we can offer some evidence on this point. In August, 1865, after a continuance of exceptionally fine weather, one of us collected some sea-water in the neighbourhood of the *Bahama Bank* lightship, and determined the total quantity of its saline constituents, together with the amount of chlorine and sulphuric acid. The proportion of solid matter contained in the water of the Irish Sea is somewhat greater in summer than in winter—the variation amounting to 0·0144 per cent.—but the relative amount of solid matter present in the water of the Irish Channel is invariably less than is contained in the water of the Atlantic Ocean lying between the same parallels.

According to Forchhammer, the mean proportion of the leading constituents of the water of the Atlantic far away from the shore is as follows :—

	Cl.	SO_3.	CaO.	MgO.	Total Salts.
Absolute amount in 1,000 grammes	19·665	2 362	0·588	2·199	35·976
Relative amount	100	11·19	2·96	11·07	181·10

Arranged in this manner, our determinations on the water of the Irish Sea give the following proportions :—

		Cl.	SO_3.	CaO.	MgO.	Total Salts.
Absolute Amount per 1,000 grammes.	Summer	18·735	2·187	—	—	34·062
	Winter	18 627	2·161	0 575	2·032	33·838
Relative Amount	Summer	100	11·67	—	—	181·91
	Winter	100	11·63	3·09	10 93	182 09

—*Paper read before the Literary and Philosophical Society of Manchester.*

ON THE ORIGIN OF THE WHITE BLOOD-CORPUSCLES.

THE question of the origin of the white corpuscles of the blood is one to which it is by no means easy to give a satisfactory reply. That they are found in large number in the lymphatic glands as well as in the so-called ductless glands represented by the spleen and thyroid glands, is undeniable; that they are taken up by the blood as it circulates through these glands is rendered almost certain, not only from a consideration of the anatomical structure which has been so beautifully elucidated by the researches of Goodsir, Frey, His, Teichmann, and a host of others, but from the results of comparative microscopical research applied to the afferent and efferent blood respectively. It even seems probable that the connective tissue of the whole body is to a certain extent subservient to the production of these corpuscles—if, indeed, it be true that the fluid of the lymphatics contains corpuscles before it has traversed any lymphatic gland whatsoever. It has long been admitted that the liver is a centre for their formation; and more recently the same function has been claimed for the muscles. Still, no attempt has been made to determine whether they proceed from pre-existing organisms of a similar nature, or whether they are generated *de novo* in the lymph. A communication, however, has lately been made by Dr. Klein to Virchow's *Archiv*, which goes far to show that they result from the fission of pre-existing corpuscles. On this Dr. Klein remarks that, in the blood of the water-newt or triton, three forms of white corpuscles can be distinguished, though not well defined from each other. The first of these are the well-known granular or granulation cells; the second are large, pale, very finely granular corpuscles; and the third are characterized by their very small size. He has observed three modes of division to occur. In the first, which is frequently visible in the granular cells, the cells assume an hour-glass form, performing at the same time very active movements; and the two halves either separate entirely, or again fuse into one. In the newly-formed cells a nucleus was sometimes perceptible. In the second mode the white corpuscle forms a thin transparent disk, from the periphery of which a projection is given off, which contains a distinct nucleus; the projection enlarges, and becomes gradually detached, whilst the disk again assumes its original globular form, and creeps away. The third mode resembles that already described by Professor Stricker in the case of the migrating corpuscles of the tongue or cornea of the frog, and consists simply in the pinching off of a minute particle of the protoplasm, which then takes on separate growth, and becomes a new corpuscle. Dr. Klein states that, in the corpuscles of the blood of the triton at least, division may occur more than once in the same cell, whilst the process may be accomplished in either of the preceding modes. He has noticed similar phenomena in the blood of the frog. In man, however, even at a temperature of 100° Fahr., division by the pinching-off process is rare. We need scarcely remark how important these observations are in reference to the rapid multiplication of cells in abscesses, and in various pathological formations; and how they supply a deficiency in our knowledge of these subjects, which has long been felt.—*Lancet.*

A Swedish School-room.—We are informed that M. Fahnehjelm, the Swedish Commissioner for the forthcoming series of Annual International Exhibitions, has applied for permission to exhibit a full-sized model of a school-room, just as it exists in the country parishes in Sweden, with all the books, maps, apparatus, forms, desks, &c., in order to give a complete idea of the Swedish system of elementary instruction. Her Majesty's Commissioners will, there can be no doubt, gladly place a sufficient space at the disposal of the Swedish Commissioner for so interesting an exhibit. It is to be hoped that encouragement will be given to other countries to follow this excellent example. An easy comparison of international appliances for educational purposes would be most useful to visitors to the Exhibition, and would be beneficial and stimulating to the countries exhibiting.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From April 3rd to 9th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Indian Python (Python molurus)	India	Deposited by the Hon. B. Fitzpatrick	Reptile-house
1 Black-fronted Lemur (Lemur nigrifrons)	Madagascar	Deposited by Lieut.-Col. Addison	Monkey-house
6 Cuming's Octodons (Octodon Cumingi)		Born in the Menagerie	Small Mammal House
1 Spotted Hyæna (Hyæna crocuta)		Ditto	Carnivora-dens
1 Sloth Bear (Melursus labiatus)	India	Presented by Capt. D. P. Murray	Ditto
1 Lanner Falcon (Falco lanarius)	Egypt	Purchased	Falcons' Aviary
1 Capistrated Squirrel (Sciurus capistratus)	North America	Ditto	Small Mammal House
1 Grey Squirrel (Sciurus cinereus)	Ditto	Ditto	Ditto
1 Kinkajou (Cercoleptes caudivolvulus)	Demerara	Deposited by the Rev. C. Kingsley	Ditto

A GEOLOGICAL DREAM ON SKIDDAW.

BY J. CLIFTON WARD, F.G.S.

IN THREE PARTS. — PART I.

ONE hot day in August, I lay dreamily gazing upon the wide and beautiful prospect seen from the summit of Skiddaw. Looking eastwards, over the wild track of Skiddaw forest, the rearward slope of Saddleback catches the eye; then the mountains around Ullswater, and Helvellyn o'ertopping all; southwards, ridge seems to rise beyond ridge in endless succession, while, immediately below, though half-hidden by the foreground, lie nestled Keswick Vale and Keswick Lake, and like a twin sister to the last, the placid waters of the river-like Bassenthwaite, beyond which, to the west and south-west is the sea-skirting plain with the smoking towns of Workington and Maryport, and sparkling in the sun, on the dim horizon beyond the sea, are Scotland's coast and Scotland's mountains, where

> "Huge Criffel's hoary top ascends,
> By Skiddaw seen."—*Wordsworth.*

As my eyes took in this wide and varied view, my mind looked back to former days, days of old, old times, when Skiddaw was not, nor the sweet lakes bathing its feet; ere Scawfell had raised its head in proud pre-eminence, or Helvellyn looked down on calm Thirlmere; when all the land was hidden beneath ocean's broad expanse, or was held in the icy grasp of an Arctic winter. Thus pondering, I fell into a deep slumber, and as I slept I dreamt.

Now it seemed to me in my dream as if I were carried away from this earth, and that, seated upon some soft white billowy cloud, I travelled through the air. The powers of my mind also seemed greatly enlarged; so that, whereas formerly I could see but some twenty or thirty miles distant, now I saw over an area equal to the whole of England, and not only so, but saw, when so my mind inclined, even into the very minutiæ of this wide prospect.

With these feelings of being carried into space, there came upon me others also of being wafted back through time, into ages long since gone by. And, with this new sensation, all temporal things seemed to vanish, and a thick mist and vapour to take their place. Long time I tried with wishful eyes to pierce this veil, for in my inward consciousness I felt that behind it was hidden, what we in our poor nature would call the beginning of days.

At last the mist rolled back, but my eyes were as yet unaccustomed to the novel sight, and the dimness that prevailed around would not allow me to distinguish land from sea; and, though I could faintly discern among the waters indistinct reefs of animals of a low type,[1] I could not as yet determine whether these were the only inhabitants of the earth or not.[2]

Age after age rolled on, and yet no land was distinctly seen, though here and there were shallows, and the white breakers seemed dancing on some half-risen tract, while afar off, in the dim horizon, the outline of a shadowy continent attracted the eye. It seemed, too, as if the waters were charged with sediment borne from this far off land, which being deposited on the ocean's bed, inclined in parts to raise it to the surface; for here and there was a low sand-bank, an embryo land, against which lashed the wild waves, and over which ever and anon some black cloud sailed, whence rain-drops fell and left their tiny imprint on the sand. Other traces of life at last dawned upon my yet bewildered sight, worms burrowed in the sand, and sea-weed-like zoophytes flourished in the shallows.[3] These were all the forms of life I could distinguish; but my sight was still weak and dim, for my newly acquired powers sat strange upon me, and like a man stepping from a dungeon into the broad blaze of day, I was for a while blinded and confused by the mighty prospect spread before me. As time wore on and I became gradually more used to the scene, new forms of life appeared,[4] sea-weeds rose and fell with the waves, shrimps and curious three-lobed crustaceans[5] abounded, pen-like hydrozoa,[6] fixed by their bases in the sand, waved to and fro, while shells and corals every here and there were seen.

Indistinctly, I now saw in my dream what appeared like a ridge of land running east and west through the northern part of our present Devon and Cornwall, and separating the northern from the southern seas. It would seem as if, through the long period that had already passed, some action from below had caused a gradual sinking in the ocean's bed, to compensate for the filling up by deposition of current-borne sediment and organic material, and thus, *generally*, no permanent land was formed. But now it seemed as if some hidden giant were rousing himself, and endeavouring to shake off the load of waters, for in many parts I saw violent commotions take place in them, and every here and there volcanic islands appeared, from which vast quantities of ashes were showered forth and fell into the surrounding sea, while currents of liquid lava, in many cases, flowed over the ocean's bed.[7] Through a long period this action went on, now at one spot and now at another, until, finally, the power from below seemed to have gained the mastery, and dry land appeared in several parts.[8] Slowly, indeed, was it upheaved, and many were the efforts of the defeated ocean's waves to destroy it as it rose; but now, at last, it stood forth, the first and earliest *distinct* trace that I had seen of future England; and as I gazed, methought I heard the dash of ocean's baffled waves upon that cliff-girt shore, and the gentle music of the running streams bearing tribute to the

[1] Foraminifers, such as *Eozoon Canadense* of the Laurentian Period.

[2] This "Dream" is an attempt at a sketch of the geological history of England, so far as it is at present known; and the author would wish it to be clearly understood that he by no means intends to assert either that foraminifers were the first inhabitants of our earth, that seaweeds and worms alone existed in Cambrian times, or that reptiles dated only from Carboniferous, and mammals from Triassic times. There may yet be discovered reptilian and mammalian remains in the oldest sedimentary rocks of which we have any knowledge, for it is not unlikely that the period of time since the Cambrian may be but short as compared with that of the world's existence in pre-Cambrian times.

[3] Cambrian Period.

[4] Lower Silurian Period.

[5] Trilobites.

[6] Graptolites.

[7] Volcanic lava and ashes of Lower Silurian age in Wales and Cumberland.

[8] Mid-Silurian times.

monarch ocean; yet, as far as my powers could ascertain, there seemed to be no warbling of sweet birds, no noisy clamour of seafowl, no howling of wild beast, no busy hum of insect; nature inanimate reigned supreme, and nature animate *seemed* yet asleep.

Time at length, however, appeared to be working a change upon this early land, and gradually, yet surely, it for the most part sank beneath the ocean, and the proud waves rolled freely o'er the spot.

Long time[9] did the waters prevail, and in them life increased and multiplied. Corals in many parts abounded, and shells of diverse form, but specially equal-sided shells.[10] There were also sea-lilies and star-fish, while the three-lobed crustaceans before mentioned seemed to be on the wane, their place being taken by huge lobster-like creatures.[11] And now, for the first time, I began to perceive fish swimming about, strangely shapen fish[12] in sooth, with bony armour and unequally lobed tails. These, with the giant lobsters, shared the sovereignty of the seas. The pen-like zoophytes, which lately had been so numerous, were wholly gone, their place being occupied by many new and varied forms.

And now, too, I saw in my dream, that while south of the east and west land barrier, many kinds of marine life abounded in a clear and open sea, subject from time to time over the area of the present Cornwall and Devon to volcanic outbursts; to the north of it there were, in the district of South Wales, many shoals and much oscillation in the sea-bed, so that large estuaries and freshwater lakes at different times occupied this particular tract, while, finally, land of considerable height reappeared in the same quarters as before (North Wales and Cumberland), with the addition of some about England's centre.[13] Down from the mountains rolled streams and rivers, carrying material which was swept far out into the wide ocean, while round the coast-line were heaped up vast shingle-beds worn from the rugged cliffs.

And now a new sight strikes my eye. Yon mountain-tops are cased in snow; an icy coldness chills the air; and the whole land seems bound in winter's steady grasp. Rivers of ice now fill the valleys where water played and leapt before, and from their ends ice-islands float far over ocean's tract.—*Pamphlet, published by Trübner & Co.*

REPORT UPON DEEP-SEA DREDGINGS IN THE GULF STREAM.

BY PROFESSOR AGASSIZ.

THE following remarks appear in the form of a review of the thirteenth number of the *Bulletin of the Museum of Comparative Zoology*, and are of especial interest at the present moment, when Dr. Carpenter's Report is passing through our pages.—[Ed. *S. O.*]

This number of the *Bulletin* sums up the results of the different expeditions, and is also especially valuable for many novel and interesting observations upon geological and zoological questions. According to Professor Agassiz, the fauna of the reef, consisting mainly of corals, extends to 10 fathoms only. The second zone, "a muddy mass of dead and broken shells, broken corals, and coarse coral sand, is chiefly inhabited by worms and such shells as by their nature seek soil of this character, with a few small pieces of living corals, some Halcyonarians, and a good many Algæ." This extends seaward "from a few miles" off Cape Florida to "twenty miles and more off Cape Sable." "A third region, or zone, beginning at a depth of about 50 or 60 fathoms, and extending to a depth of from 200 to 250 fathoms, constitutes a broad slanting table-land, beyond which the sea-bottom sinks abruptly into deeper waters. The floor of this zone is rocky. It is, in fact, a limestone conglomerate, a kind of lumachelle, composed entirely of the remains of organized beings, animals now living upon its surface." Algæ are but sparsely represented upon the plateau, and though the animals are abundant the species are generally of small size, and belong to genera either identical or closely allied to those of the Cretaceous period. The deep sea proper beyond this zone lies upon "a uniform accumulation of thick, adhesive mud, with a variety of worms and such shells as seek muddy bottoms." Professor Agassiz thinks that if the bottom in these depths was rocky, animal life would be "as varied and as numerous comparatively as are the Alpine plants on the very limits of perpetual snow."

With reference to geology, Professor Agassiz says that he infers from the character of the sea bottom that probably none of the layers of stratified rock on the surface of the globe "have been formed in very deep waters," but around the shore-lines of the ancient continents, which have been subject only to comparatively slight changes of level after they were once elevated above the primeval ocean.

In the main bearing of this conclusion Professor Agassiz agrees with Dana's theory of the gradual development of continents, a view which of late has been steadily gaining in adherents, especially in this country. The statement, however, that probably no stratified rock has been formed in deep water is open to serious objections. The chalk, the Nummulitic limestone, the Eozoonal limestone, and others of like constitution are composed in great part of foraminiferous animals especially fitted to flourish at great depths, and probably, so far as we can judge from soundings and dredgings, covering at the present day a large portion of the Atlantic bottom.

The description of the physical contrast between the shelving of the Florida shore and the abruptness of the Cuban side and Bahama reefs, with the minute analysis of the formation and disintegration of the rocks of the Double-headed Shot Key, Salt Key, and others, will be read with the greatest interest by all geologists. We could not do justice to this part of the publication without quoting several entire pages, and this we have not space for.

Generally speaking, the Keys are formed, according to Professor Agassiz, of fine coral sand, which is washed up on to the higher shallower parts, and forms banks, upon which accumulate a conglomerate of broken shells, corals, and coarse oölithes to the height of high-water mark. Upon this foundation rock reposes another accumulation of similar material, distinguished, however, by the steep inclinations of the beds which rise to the height of 12 or 15 ft. These last furnish the fine material which is swept away by the wind to form sand-dunes.

The more homogeneous limestones are formed in the less exposed places, and Professor Agassiz mentions that these are "frequently as hard as the hardest limestone of the secondary formation."

The author then passes to the consideration of the development of corals, and states that these investigations have led him to regard the Actinians as the lowest, the Madreporarians next, and the Halcyonarians as the highest among the corals. Among the Madrepores the sequence of the genera is Turbinolia, Fungia, Astræa, and Madrepora. "Young Astræans, before assuming their solid frame, are Actinia-like; their first coral frame is Turbinolia-like, and from that stage they pass into a Fungia-like condition, before they assume their characteristic Astræan features." It is next proved, that the succession of types in geological times, and their bathymetrical distribution from the deepest water to the shallow, corresponds, so far as the Madreporarians are concerned, to the succession in rank of the adult types as determined by different phases of their development. Thus, both as regards rank in classification, and the succession of the different phases of development, as well as the successive appearance of types in the progress of geological time, and the vertical distribution of

[9] Upper Silurian period. [10] Brachiopods. [11] Eurypterus, pterygotus, &c.
[12] Cephalaspis, pteraspis, &c. [13] Devonian period.

A NEW ZEALAND UNDERGROUND PARASITE (*DACTYLANTHUS TAYLORI*).

FIG. 1, Spike, natural size; FIGS. 2 and 3, Stamens; FIG. 4, Pollen, all magnified; FIG. 5, Spike, natural size; FIGS. 6, 7, and 8, Flowers, magnified.

these types on the seashore, the Turbinolian type is found first, and is followed in succession by the Fungian, the Astræan, and the Madreporian types. These views also seem to be in accord with those of Alexander Agassiz, who, as previously cited, compares the deep-water Echinoids to the Cretaceous, and those of intermediate depths to tertiary genera. It would seem, therefore, if the latter be true, that, *à priori*, the former would acquire a still higher degree of probability, so far as the agreement of the succession in time and depth is concerned.—*American Naturalist*, March.

DACTYLANTHUS TAYLORI.

THE figure illustrating the remarkable parasitic plant described in Mr. Taylor's book on New Zealand, which we promised to reproduce, appears above. Mr. Taylor gives the following description of it:—

"This singular plant is a parasite which, unlike others found on branches, attaches itself to the roots of trees, and blooms underground, though a few of the flowers occasionally appear above the surface. The natives say it is allied to the Freicenetia (*kie-kie*); it certainly bears some resemblance in form to the *tawera*, the flower of the *kie-kie*, which may account for its being likened to it; but in every other respect it is quite different, having no leaves, but the stalk is covered with brown scales; the petals of the flower are slightly tinged with pink in the centre, but in general they are of a dirty white or brown colour, and transparent; the stamens are white; the flowers have a strong smell, partly fragrant, though earthy and unpleasant. This plant forms a large excrescence on the root of the *Tataka pittosporum*, which is covered with warts; these increase and become buds, a dozen or more flowers are often on one stem. I first met with it on a mountain range near Hikurangi, returning from Taupo, and noticed it growing amongst the roots of a tree near the path. I tried to discover its root, but in vain, not having anything but a pocket-knife to dig with; however, I secured one flower and its stalk, which appeared above the surface. Mr. Nairn, a settler, told me he had seen a similar parasite in the forest at the base of Mount Taranaki; this was also attached to the root of a tree, and had a number of flowers upon it of a light blue colour. Mr. Williamson afterwards brought me another specimen, which he had found in clearing some ground. The whole plant and flowers were entirely covered with vegetable mould; the stem between the bracts was of a rusty brown; there were twenty-five flowers open at once, another excrescence had eighteen. He states the odour of one plant was something like that of a ripe melon, whilst the other had also a disagreeable earthy smell."

REVIEWS OF BOOKS.

The Ornithosauria: an Elementary Study of the Bones of Pterodactyles, made from Fossil Remains found in the Cambridge Upper Greensand, and arranged in the Woodwardian Museum of the University of Cambridge. By HARRY GOVIER SEELEY, of St. John's College, Cambridge. Cambridge: Deighton, Bell, & Co. London: Bell & Daldy. 1870.

MR. SEELEY'S essay on the Ornithosauria will be found to be an exceedingly valuable addition to the library of the student of Palæontology. It forms a part of the Catalogue of the Woodwardian Museum which Professor Sedgwick is having prepared. This Catalogue is planned in three parts: the first being an index to the specimens; the second, a series of memoirs upon the orders and classes of animals concerning

which new knowledge is afforded by the specimens; the third, a series of memoirs of species in the collection which are unknown to scientific writings. The present memoir belongs, therefore, to the second part of the Catalogue.

After giving the views of Cuvier, Goldfuss, Wagner, Von Meyer, and others, on the organization of the Ornithosaurs, the author gives his own theory on the subject, namely, that their organization was essentially that of birds; at the same time, that in the details of their organization they were distinct. They form, in fact, a new sub-class of vertebrates of equal value with the class of birds.

The specimens are described in the order of limbs, vertebral column, and cranium, the descriptions forming together an admirably elaborated account of the comparative anatomy of this group of the animal kingdom. Twelve plates of lithographs illustrate these descriptions.

Alpine Flowers for English Gardens. By W. Robinson, F.L.S., Author of the "Parks, Promenades, and Gardens of Paris." London: John Murray. 1870.

THIS is a handsome volume, written to encourage the cultivation of Alpine flowers in our rock-gardens. The greater part of it consists of descriptions of the choicest mountain flowers from the horticulturist's point of view. The first part treats of the formation and arrangement of rock-gardens, and is full of desirable information Through the whole volume the author shows a zeal for his subject which will, of itself, probably go far to make disciples of many of his readers. He strongly combats the notion that Alpine flowers cannot be cultivated in lowland regions. After describing their homes in eloquent language, he continues:—

"But let it not for a moment be supposed that these conditions are indispensable for their growth! The reason that they predominate in these very elevated regions is, that no taller vegetation can exist there. Were these places inhabited by trees and shrubs, we should yet find Alpine plants among them; but much fewer than in the rocky fields where they reign supreme. Thus many plants found on the high Alps, and popularly considered to grow only within sight of or among fields of snow, are met with in open rocky or bare places at much lower elevations. *Gentiana verna*, for example, is one of the loveliest gems in the Flora of the Alps, often flowering late in the summer when the snow thaws on a high mountain; yet it is also found on comparatively low hills, and occurs in Ireland and England. Numbers of other subjects could be mentioned of which the same is true. In the fierce struggle for existence upon the plains and low tree-clad hills, the more minute species are often overrun by trees, trailers, bushes, and vigorous herbs; but where in northern and elevated regions these fail from the earth we get the choice jewellery of vegetable life known as Alpine plants."

This theory the author sustains by the facts given in the body of the work concerning the cultivation of many of these plants. We hope that this book may be the means of making the cultivation of many of the loveliest of these flowers much more general than it is. "A Little Tour in the Alps" will be found a not uninteresting part of the volume, and everywhere throughout the whole of it the author has striven to render amusing his accounts of the necessary details.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

Underground Temperature.

Sir,—I send you the temperature observed by me at 2 ft. deep in March, 1869 and 1870.

1869.		1870.	
March 1	44°	March 1	39°
		2 and 3	40°
		4	42°
		An explosion in a coal-mine in the north of England, and a violent gale of wind.	
8	43°	March 5 to 13	40°
		14	39°
15	40°	15	38°
		16	39°
		17	40°
22	41°	18 to 23	42°
		24 and 25	41°
		26 to 29	40°
29	41°	30 and 31	39°

Havant. C. J. R.

Sir W. Thomson *versus* Geology.—*From* P. W. Stuart Mentreath.

Sir,—I will justify my position *en deux mots*. When, as has been shown, *Sir W. Thomson* has *no case*, little can be *required* on the other side.

I am attacking a mathematician whose qualified supporters (see *North British Review*, 1864–65–69) show that his position is incompatible with Geology, Darwinism, Metaphysics, Logic, Philosophy, Mayer *and his supporters* ("we feel that the writer [Mayer] and his supporters are, as regards method, little in advance of the dark ages," Tait's *Thermodynamics*)—and whose position is thus fairly shown to be absurd. I explain his cosmogony by the one-sided habit of too exclusive deductive reasoning, which leads the mathematician to imagine mental abstractions to be *necessarily* antecedent to the observed course of nature which those abstractions imperfectly formulate (*vide* Aristotle *versus* Plato, Nominalists *versus* Realists, &c.).

Weeding common principles of reasoning, which a modern analyst will admit, I find none but that of Professor Sylvester (regarding Gauss, Cayley, Riemann, Schalfli, &c., *Nature*, No. 9); and accepting it, I can cite *more than six* eminent uniformitarians, and I may consider them as "privileged intellects." I grant that modern scientists

are little in advance of the "dark ages," but I hold that modern analysts are a great deal in the other direction.

That the observed course of nature be admitted permanent, is a universal principle of common sense, and the distinction between the "course" and the "laws" has never been defined. That there are good particular reasons for Uniformitarianism, none who know its literature doubt. I mention three :—

1. That it has never been successfully refuted.
2. That it is consistent with all practical geological work.
3. That it eliminates unprofitable discussions.

I remain, &c.,

St. Jean de Luz, April 1. P. W. STUART MENTEATH.

P.S.—I might have indisputably established (by quotations) that Sir W. Thomson *does not* only attack Uniformitarianism; and I might have shown the true meaning of his term "speculation," but I think it needless. I have brought the question *ad abyssum* (a mediæval term); there I wish it joy, and may predicate what I please.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, APRIL 7TH.—"On the Relation between Sun's Altitude and the Chemical Intensity of Total Daylight in a Cloudless Sky," by Henry E. Roscoe, F.R.S., and T. E. Thorpe, Ph.D.—In this communication the authors give the results of a series of determinations of the chemical intensity of total daylight made in the autumn of 1867 on the flat tableland on the southern side of the Tagus, about 8½ miles to the south-east of Lisbon, under a cloudless sky, with the object of ascertaining the relation existing between the solar altitude and the chemical intensity. The method of measurement adopted was that described in a previous communication to the society,[1] founded upon the exact estimation of the tint which standard sensitive paper assumes when exposed for a given time to the action of daylight. The experiments were made as follows :—

1. The chemical action of the total daylight was observed in the ordinary manner.
2. The chemical action of the diffused daylight was then observed by throwing on to the exposed paper the shadow of a small blackened brass ball, placed at such a distance that its apparent diameter, seen from the position of the paper, was slightly larger than that of the sun's disk.
3. Observation No. 1 was repeated.
4. Observation No. 2 was repeated.

The means of observations 1 and 3 and of 2 and 4 were then taken. The sun's altitude was determined by a sextant and artificial horizon, immediately before and immediately after the observations of chemical intensity, the altitude at the time of observation being ascertained by interpolation.

It was first shown that an accidental variation in the position of the brass ball within limits of distance from the paper, varying from 140 millims. to 230 millims., was without any appreciable effect on the results. One of the 134 sets of observations was made as nearly as possible every hour, and they thus naturally fall into seven groups, viz. :—

(1) Six hours from noon, (2) five hours from noon, (3) four hours from noon, (4) three hours from noon, (5) two hours from noon, (6) one hour from noon, (7) noon.

Each of the first six of these groups contain two separate sets of observations: (1) those made before noon, (2) those made after noon. It has already been pointed out,[2] from experiments made at Kew, that the mean chemical intensity of total daylight for hours equidistant from noon is constant. The results of the present series of experiments proves that this conclusion holds good generally, and a table is given showing the close approximation of the numbers obtained at hours equidistant from noon.

Curves are given showing the daily march of chemical intensity at Lisbon in August, compared with that at Kew for the preceding August, and at Parà for the preceding April. The value of the mean chemical intensity at Kew is represented by the number 94·5, that at Lisbon by 110, and that at Parà by 313·3, light of the intensity 1·0 acting for 24 hours being taken as 1,000.

[1] Roscoe, Bakerian Lecture, 1865.

[2] *Phil. Trans.* 1867, p. 559.

The following table gives the results of the observations arranged according to the sun's altitude.

No. of observation.	Mean altitude.	Chemical Intensity. Sun.	Sky.	Total.
15	° ′ 9 51	0·000	0·038	0·038
18	19 41	0·023	0·063	0·085
22	31 14	0·052	0·100	0·152
22	42 13	0·100	0·115	0·215
19	53 09	0·136	0·126	0·262
24	61 08	0·195	0·132	0·327
11	64 14	0·221	0·138	0·359

Curves are given showing the relation between the direct sunlight (column 3) and diffuse daylight (column 4) in terms of the altitude. The curve of direct sunlight cuts the base line at 10°, showing that the conclusion formerly arrived at by one of the authors is correct, and that at altitudes below 10° the direct sunlight is robbed of almost all its chemically active rays. The relation between the total chemical intensity and the solar altitude is shown to be represented graphically by a straight line for altitudes above 10°, the position of the experimentally determined points lying closely on to the straight line.

A similar relation has already[3] been shown to exist (by a far less complete series of experiments than the present) for Kew, Heidelberg, and Parà; so that although the chemical intensity for the same altitude at different places and at different times of the year varies according to the varying transparency of the atmosphere, yet the relation at the same place between altitude and intensity is always represented by a straight line. This variation in the direction of the straight line is due to the opalescence of the atmosphere; and the authors show that, for equal altitudes, the higher intensity is always found where the mean temperature of the air is greater, as in summer, when observations at the same place at different seasons are compared, or as the equator is approached when the actions at different places are examined. The differences in the observed actions for equal altitudes, which may amount to more than 100 per cent. at different places, and to nearly as much at the same place at different times of the year, serve as exact measurements of the transparency of the atmosphere.

The authors conclude by calling attention to the close agreement between the curve of daily intensity obtained by the above-mentioned method at Lisbon, and that calculated for Naples by a totally different method.

"On the Acids contained in Crab Oil," by William J. Wonfor, Student in the Laboratory of the Government School of Science, Dublin.—Crab oil is obtained from the nuts of a tree named by botanists *Hylocarpus carapa*, and also *Carapa Guianensis*. The tree grows abundantly in the forests of British Guiana; the oil is prepared by the Indians, who bring it to George Town for sale. The oil is obtained from the kernels by boiling them for some time, and then placing them in heaps and leaving them for some days; they are then skinned, and afterwards triturated in wooden mortars until reduced to a paste, which is spread on inclined boards and exposed to the sun; the oil is thus melted out, and trickles into receiving-vessels.

As no investigation, so far as I have been able to ascertain, has ever been made of the acids contained in this oil, Professor Galloway, to whom I am indebted for the samples of the oil, recommended me to examine them, and the examination was conducted under his direction.

The oil was in the state in which it is sold by the Indians; it possessed the appearance of a semi-fluid butyraceous mass, evolving a peculiar penetrating odour; its melting-point was 55° C. To obtain the acids, the oil was saponified with a solution of potassic hydrate, and the soap thus obtained dissolved in a large quantity of distilled water; to the solution sodic chloride was added in considerable excess; the soap which separated was washed and afterwards dissolved, and the solution treated with hydrochloric acid, the liberated fatty acids were collected and pressed, then melted in boiling water, and frequently washed to remove all traces of sodic chloride; the acids were again saponified, and again treated with sodic chloride, but the soda-soap was on this occasion decomposed with tartaric acid; the mixed acids had a melting-point of 40° C.

The acids were dissolved in boiling alcohol of 89 per cent.; the solution, on cooling, deposited a white radiated crystalline mass, which was repeatedly recrystallized from alcohol until it obtained a constant melting-point; it was then saponified with a solution of potassic carbonate, and the solution of the mixed potash salts was evaporated to dryness on the water-bath; the fat salt was then dissolved in absolute alcohol. The alcoholic solution, unless extremely dilute, does not crystallize on cooling, but merely forms a strong jelly, which was, after pressing, dissolved in water, and the fat acid separated by a strong solution of tartaric acid; the separated acid was washed with boiling water until all potassic tartrate and tartaric acid were removed; it was subsequently twice crystallized from absolute alcohol; its melting-point was then found to be 57° C. The acid, when pure, presents the appearance of a white glistening radiated crystalline mass; two combus-

[3] *Phil. Trans.* 1867, p. 555.

tions were made; the acids employed in the two analyses were obtained from two different saponifications.

These analyses agree very closely with the formula for palmitic acid, $C_{16} H_{32} O_2$.

Preparation of the Soda-Salt.—The acid was saponified with a dilute solution of sodic carbonate, the jelly-like mass was pressed, dried, and the fat salt dissolved out with absolute alcohol; the alcoholic solution, when cold, gelatinized; the gelatinous mass was pressed, dried, and dissolved in alcohol, and filtered.

Preparation of the Silver-Salt.—The soda salt was dissolved in hot water, and precipiated by argentic nitrate; the precipitate was washed in the dark.

Preparation of the Ether.—Dry hydrochloric acid gas was passed to saturation through a warm solution of the acid in absolute alcohol; the solution was then diluted with water, which caused the ether to separate as a yellowish oil, which, as it became cold, assumed the appearance of a waxy body; it was boiled with water, and afterwards with a hot dilute solution of sodic carbonate; it was again dissolved in alcohol, and precipitated from this solution by water; it was then collected and dried.

Preparation of the Baric Salt.—A hot alcoholic solution of the acid was saturated with ammonia in slight excess, and boiled with a solution of baric acetate; the precipitate falls as a white flocculent mass, which, when thoroughly washed, dried and powdered, has the appearance of a glistening spongy powder.

The analysis of the acid, the silver-salt and the ether, along with the determination of the baryta in the baric salt, sufficiently indicate that the acid under examination was palmitic acid, although I could never obtain, even after fractional precipitation, a higher melting-point for the acid than 57° C.

The difference in the melting-points of the acid mass before it was treated with alcohol, and the melting-point of the palmitic acid, indicated that at least one other acid was present, but in very minute quantity.

I attempted to determine the nature of the acid of lower melting-point by exposing the residues obtained from the first three crystallizations of the hard acid to cold in a bath of sodic sulphate and hydrochloric acid, all the hard acid which crystallized out being rejected; the portion which remained fluid was saponified with potassic carbonate, and the solution of the potash soap was subjected to fractional precipitation by means of plumbic acetate; the second and smaller precipitate was collected and washed, and treated for some time at a moderate temperature with dilute sulphuric acid; this caused the separation of a reddish oily-looking liquid which was collected and dissolved in boiling alcohol; it was afterwards saponified with potassic carbonate, and the silver-salt prepared from that salt. I only obtained sufficient of the silver-salt from about 2 lb. of oil to make one determination of the silver and one of the carbon and hydrogen, and from these determinations I did not obtain concordant results, and want of material compelled me to relinquish the further examination of the acid.

The following is the continuation of Dr. Davies's paper from last week's SCIENTIFIC OPINION, p. 332:—

To illustrate the value of this approximative law, I will exemplify, in a case of mitral constriction detailed by Dr. Walshe (*Diseases of the Heart*, p. 373), the mode in which the amount of constriction may be calculated.

Mitral Constriction.

	Circumference.	Area.
Tricuspid	$4\frac{7}{8} = 4{\cdot}875$ in.	1·9 sq. in.
Pulmonic	$3\frac{1}{8} = 3{\cdot}125$	·77
Mitral	$1\frac{7}{8} = 1{\cdot}875$	·28
Aortic	$2\frac{3}{8} = 2{\cdot}375$	·45

$$\frac{\text{Tricuspid}}{\text{Mitral}} = \frac{1{\cdot}9}{{\cdot}28} = 7, \text{ nearly.}$$

$$\frac{\text{Pulmonic}}{\text{Aortic}} = \frac{{\cdot}77}{{\cdot}45} = 1{\cdot}7, \text{ nearly.}$$

Hence the tricuspid (by reason of the extreme narrowing of the mitral opening) is seven times larger in area than the latter orifice, in place of being only 1·3 to 1·4 times larger in area. If we suppose the tricuspid to be nearly normal, then as

$$\frac{\text{Area of tricuspid}}{\text{Area of mitral}} = 1{\cdot}3, \text{ nearly;}$$

$$\therefore \text{ area of mitral (healthy)} = \frac{\text{area of tricuspid}}{1{\cdot}3}$$

$$= \frac{1{\cdot}9}{1{\cdot}3} = 1{\cdot}45 \text{ sq. in.}$$

Hence the amount of the contraction of the mitral orifice = 1·45, the normal size
= ·28, its actual size.

= 1·17 sq. in.

The diseased aperture just admitted the end of the index figure; its edge was rugose, and the valve was funnel-shaped towards the ventricle. The left auricle was much hypertrophied, its walls in some parts being ¼ in. in thickness, and its endocardium creaked on being touched. The pulmonic is evidently large in proportion to the aortic opening (the ratio being 1·7 instead of 1·3 to 1·4); and there was no doubt considerable hypertrophy and dilatation of the right ventricle. The increase in the area of the pulmonic aperture was the direct result of this condition of the right side of the heart. The tricuspid was also probably somewhat dilated, as the "valves looked insufficient to fill the widened orifice," and the jugular veins appeared during life to be swollen and pulsatory; but the absolute size of the tricuspid shows that the dilatation was not excessive. The area of the aortic opening appears to be below the mean amount. Was this the result of the small supply of blood which the left ventricle received and impelled into the general system? In any case a knowledge of the existence of this law enables us to read the measurements of the orifices and their respective ratios with increased interest.

It would be interesting to pursue the application of this law in the study of the various forms of valvular disease. I purpose, however, to return to this subject at the end of this paper, and shall seek now to trace out the reasons why the four orifices present such differences in the magnitude of their areas.

And as the foundations of our arguments we must admit the truth of the two following propositions:—(1) That the ventricles and auricles act exactly synchronously respectively; and (2), that equal volumes of blood pass in exactly equal and the same times respectively through any two corresponding orifices of the healthy heart.

1. "If we examine," says M. Marcy "the lines traced by the right and left ventricles, we find a most perfect synchronism in the respective commencements and terminations of their contraction."

"The examination also of a heart exposed during life confirms the deduction; for if we grasp the auricles or the ventricles, we cannot detect the smallest interval between the contractions of parallel cavities."

Again. Stethoscopic examination of the heart demonstrates the existence of only one first sound and of only one second sound, although the causes producing each of those sounds are twofold, inasmuch as they really reside in two (right and left) hearts, placed in close and intimate apposition to one another. Under rare circumstances the sound which results from the closure of the semilunar valves has been found reduplicated; but although such an event may occur from the non-synchronous fall of the valves, it is clear that an unimpeded and uninterrupted circulation could not be maintained unless the two sides of the heart, or really the two hearts, contracted and dilated exactly synchronously. Whether the organ acts violently or feebly, with regularity or intermittently, the auscultator detects but two sounds; and even when its valves are diseased, its orifices immediately altered in diameter, and its muscular walls hypertrophied or atrophied, we find the same law of synchronism presiding over the heart and its sounds, normal or abnormal.

Lastly. An examination by dissection of the fibres which compose the walls of the ventricles, conclusively proves that these chambers must inevitably act exactly synchronously. In Dr. Pettigrew's masterly account of the arrangement of the muscular fibres in the ventricles of vertebrate animals, we find the following remarks made upon this point:—"The fibres of the right and left ventricles anteriorly and septally, are to a certain extent independent of each other; whereas posteriorly many of them are common to both ventricles; i. e. *the fibres pass from the one ventricle to the other.*" The drawings 49 and 50 in the memoir, clearly prove how "the common fibres pass from the left to the right ventricle and dip in or bend at the track of the anterior coronary artery to become continuous with fibres having a similar direction in the septum." [4]

2. In the next place, it must be admitted that equal volumes of blood pass in exactly equal and the same times through any two corresponding orifices of the heart; for if, for example, we could suppose the quantity thrown out through the pulmonic orifice into the lungs to be *persistently* greater than the amount thrown out in *the same time* through the aortic opening into the general circulation, it would inevitably follow that overwhelming pulmonary engorgement, cessation of flow from the right heart, and death would rapidly ensue. The alternative supposition of the right ventricle persistently discharging into the lung-capillaries an amount of blood actually less than the quantity as persistently sent forth by the left ventricle into the systemic circulation, involves physical contradiction unnecessary to refute. Whatever, therefore, may be the actual capacities of the ventricles, or the quantities which under pressure they may be made to contain, this law must be always paramount to enable the healthy heart to act freely and without the production of a congested or overloaded condition of the pulmonic or systemic circulation; *the quantities of blood entering the ventricles synchronously must be equal*, and

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[4] *Phil. Trans.* part 3, 1864.

the quantities leaving them synchronously must also be equal; and to prevent the occurrence or production of cardiac congestion the quantity of blood received by the ventricles in diastole must equal the quantity expelled by the ventricles in systole, small deviations being allowed within certain limits of health. We shall see the bearing of these latter remarks when we consider the mode in which hearts much diseased in their orifices and valvular apparatus, are often enabled to carry on a tolerably unembarrassed circulation, and with but little functional disturbance experienced by the individual so circumstanced.

The anatomy of the organ fully corroborates the principle we are seeking to establish; for we are told that "the capacities of the ventricles are probably equal" (Cruveilhier); and again, "there are reasons for believing that during life any difference between the capacities of the ventricles is very trifling, if it exist at all." [5]

And lastly, "the whole, or very nearly the whole of the blood contained in the ventricles is discharged from them at each systole; for the left ventricle is frequently found quite empty after death; and if a transvere section be made through the heart in a state of well-marked rigor mortis (which may be considered as representing its ordinary state of complete contraction), the ventricular cavity is found to be completely obliterated."

From these considerations we may, I believe, fairly assume that

1. { Equal times of ventricular contraction, / Equal times of ventricular dilatation,
2. { Equal or almost equal volumes of blood received in diastole, / Equal or almost equal volumes of blood expelled in systole,
3. Equal or almost equal capacities of ventricles,

are the main characteristics of a heart which is normal in structure and perfect in function.

1. In employing the words "equal times" with reference to the periods respectively occupied by the contraction and dilatation of the ventricles, I would wish to refer for a moment to the statements made by our leading authorities as to the average duration of the systole and diastole of the healthy heart.

Dr. Carpenter states that the ventricular contraction occupies two-fifths and the ventricular dilatations three-fifths of the time which elapses between two consecutive beats of the pulse. Dr. Walshe informs us that the time from the commencement of the first to the beginning of the second sound ("which is synchronous with the diastole of the ventricles") is, on an average, one half of the time from pulse to pulse. Dr. Burdon Sanderson, in his *Handbook of the Sphygmograph*, says, "There are several facts not difficult of observation which show that the time occupied by the heart in contracting is very much shorter than is commonly supposed. The first sound being synchronous with the commencement of the contraction of the ventricles and the closure of the mitral valve, and the second with the closure of the aortic valves, it is clear that the intervals between these two events expresses the duration of the contraction of the heart. Now the most unpractised auscultator can readily satisfy himself, while listening to the sounds of a heart contracting sixty times in a minute, that the time between the first and second sounds is not equal to that which separates the second from the first; and that it cannot be admitted for a moment (as stated in our leading physiological text-books) that a heart occupies half of a second in contracting."

This statement is borne out in the last edition of Kuke's *Physiology* edited by Morant Baker, in which the periods of ventricular contraction and dilatation are considered to be in the ratio of 4 to 7. Chauveau's experiments on the living horse and the sphygmographics tracings of the radial pulse in man, clearly indicate that the times of ventricular contraction and dilatation are very difficult in duration; and the influences which are deducible from the study of the comparative areas of the four orifices will fully substantiate the statement that the systole of the ventricles "is a much shorter proceeding than is usually supposed."

2. And again, with regard to the words "equal volumes of blood" used above, I need scarcely remark that the same volume (quantity, ounces, cubic inches) of blood is not persistently and at all times received by and thrown out of the heart at every complete revolution of the organ. The reverse is, in fact, nearer the truth; for the ventricles (though of course always full from the impossibility of a vacuum existing in their interior) vary considerably from time to time in their degree of fulness and expansion. In profound sleep, or in the perfect rest and muscular relaxation of the recumbent posture, the flow of blood through the heart is entirely and solely under the control of the heart itself (some allowance being made for the effects of the respiratory movements which "act on the whole advantageously to the circulation"), the right being filled by the contractile energy of the left side of the organ. In our waking movements, however, during exertion, every movement of the body tends to force the blood in the veins in an onward course towards the right chambers of the heart, which would become gorged from over-distension did not the healthy right ventricle assume corresponding energy and force and expel the blood with increased rapidity into the capillaries of the lungs. An increase in the number and depth of the respiratory movements ensues accelerating the passage of the blood through the lungs to the left side of the heart, which by an instinctively increased reaction upon its contents, propels the blood forcibly into the systemic circulation. The so-called vital capillary force or interaction between blood and tissue may assist in forwarding the current, but its amount is evidently excessively small in comparison with the enormous contractile energy of the two ventricles. Violent and sudden exertion may for a short time disturb the balance between the two hearts (the cavæ and right auricle in one side, and the pulmonary vessels and left auricle in the other side being, for a time, the safety reservoirs or receptacula of the blood waiting to be forwarded); but with bodily rest equilibrium becomes rapidly re-established, and equal volumes of blood are again poured forth in equal and the same times from the two ventricles of the heart.

(*To be continued.*)

[5] *Quain's Anatomy*, by Dr. Sharpey, vol. iii. p. 255.

ENTOMOLOGICAL SOCIETY.

APRIL 4TH.—A. R. Wallace, Esq., president, in the chair. The ravages committed in granaries by *Calandra granaria* and *C. oryzæ*, and the means of preventing or removing the same, formed the principal subject of discussion, which was participated in by Mr. J. Jenner Weir, Mr. James Vogan, Mr. Albert Müller, Mr. Janson, Prof. Westwood, Mr. M'Lachlan, Mr. F. Smith, the Rev. H. S. Gorham, and the president.

Various exhibitions were made by Messrs. Weir, Janson, Howard Vaughan, F. Smith, and the secretary.

Mr. Albert Müller read a note on the odour of certain Cynipidæ, and Mr. G. R. Crotch communicated some observations on British species of Dasytidæ.

THE INSTITUTION OF CIVIL ENGINEERS.

APRIL 5TH.—Charles B. Vignoles, Esq., F.R.S., president, in the chair. The paper read was "On the Dressing of Lead Ores," by Mr. T. Sopwith, jun., M. Inst. C.E.—This communication was limited to a description of some works the author had had occasion recently to establish in Spain, for the dressing of lead ores, as a general account of the present state of such operations in England could not be satisfactorily given in a single paper. Moreover, as regarded this branch of mechanical engineering, Germany was in advance of England.

At the monthly ballot, the following candidates were balloted for and duly elected; as members—Messrs. J. Bailey, W. Elsdon, A. K. Mackinnon, and T. F. McNay; and as associates—Messrs. J. Anstie, B.A., J. C. Boys, T. Cargill, J. R. France, H. Gaerth, D. Gravell (Stud. Inst. C.E.) Lieut. G. E. Grover, R.E., F. James, J. Kincaid, B.A., H. E. Milner, T. Newbigging, E. B. Ricketts, F. W. Stent, F. J. Tatam, and C. E. Trottor (Stud. Inst. C.E.).

ANTHROPOLOGICAL SOCIETY OF LONDON.

APRIL 5TH.—Captain Bedford Pim, R.N., V.P., in the chair. A paper, by Mr. Hodder M. Westropp, was read, "On Phallic Worship."—The author, after asserting the spontaneity and independence of certain beliefs and superstitions in the human mind, at all times and in all climates, proceeded to trace out the rise and development of phallic worship as one of the most ancient of those religions that have extensively prevailed among various sections of the human race. In the earlier ages the operations of nature made stronger impressions on the mind of man than in the later periods of his history. There were two causes which must have engaged the attention of the savage observer of nature, the generative and the productive, the active and passive. The author then described what he conceived to have been the process of thought, founded on analogies from the observation of the great forces of nature by the Egyptians, Assyrians, Hindus, Chinese, Phœnicians, Greeks, Romans, the aborigines of America, Australasia, and Polynesia, and on the unquestioned evidence of phallic worship in its various phases, belonging to those peoples. That worship was always, among the ancients, of a purely reverential kind, and partook of nothing obscene, either in its teaching or its observance; it was a homage paid to the most potent and most mysterious of the powers of nature—the power of procreation.

Mr. C. Staniland Wake then read a paper, "On the Influence of the Phallic idea in the Religions of Antiquity."—After showing that the phallic superstition originated in the desire for children, and in the veneration for the instruments through which this desire was gratified, the paper proceeded to consider the legend of the "fall," which is proved to have had a phallic basis, from the association with it of the serpent, the tree, and the cherubim, all of which embody phallic ideas. The legend itself was derived from a Persian source, although it originated with the Chaldeans. The paper then traced the worship of the

pillar-god, the Syro-Egyptian Hermes-Thoth, and the deity symbolized by the *beth-el* of the Hebrew patriarchs, showing its connection with the Sun-worship introduced by Abraham, and the primeval worship of Saturn. The generative attribute of this deity had, however, more especial reference to *man*, and the bull, which afterwards became the symbol of the Sun-god, was used as the emblem of fecundity in *nature*. The peculiar symbol of the pillar-gods as sun-deities was the serpent. The progress of sun-worship was shortly pointed out, and the development of the idea of "wisdom," attributed to the Aryan and Grecian deities. After referring to the deluge-legend, the paper concluded with a notice of the phallic character of Hindnism and Buddhism, and the phallic symbols of Christianity.

In the discussion which ensued the following gentlemen took part, Mr. James Furguson, Mr. Bouverie Pusey, Mr. Robert des Ruffières, Mr. Lewis, Mr. Charlesworth, Mr. John Jones, Mr. Moncure Conway, Mr. Dendy, Rev. Mr. Buckle, Mr. McSweeny, Mr. Simpson, Mr. Villin, Mr. Avery, Mr. Rivington, and the chairman.

LITERARY AND PHILOSOPHICAL SOCIETY OF MANCHESTER.

ORDINARY MEETING, MARCH 8TH. — J. P. Joule, D.C.L., LL.D., F.R.S., &c., president, in the chair. Sir James Cockle, M.A., F.R.S., president of the Queensland Philosophical Society, was elected a corresponding member of the society.

The following letter from Mr. Dancer, F.R.A.S., dated March 5, was read:—I was not present at the last ordinary meeting on February 22nd, but seeing my name mentioned in the printed report of Dr. A. Ransome's paper, "On the Organic Matter of Human Breath," in which it is stated "that Mr. Dancer's calculation of the number of spores in the air was noticed, but a source of error was pointed out in the readiness with which organisms are developed in suitable fluids even in the course of a few hours," in reply I have to state that this very obvious source of multiplication did not escape attention, which a few extracts from the printed paper in the *Proceedings* of March 31st, 1868, will suffice to show. It is stated that "during the first observations few living organisms were noticed, but as it afterwards proved, the germs of plant and animal life (probably in a dormant condition) were present." Again, at the bottom of the same page—"When the bottle had remained for 36 hours in a room at a temperature of 60° the quantity of fungi had visibly increased, and the delicate mycelial thread-like roots had completely entangled the fibrous objects contained in the bottle and formed them into a mass." I may add that the contents of the bottle were very frequently subjected to critical examination for any change in their appearance from the time I received it from Dr. R. A. Smith until all appearance of vitality had ceased. The amount of solid matter suspended in the atmosphere is exceedingly variable; after continued rain the air is comparatively free, whereas in very dry weather with high wind, in localities where dust and decomposing matter are abundant, it will be found at a considerable altitude.

E. W. Binney, F.R.S., called the attention of the meeting to the frightfully high death-rate of Manchester and Salford, which continued to increase, notwithstanding the appointment of officers of health, and the doings of the councils of the two towns.

"On the Suspension of a Ball by a Jet of Water," by Osborne Reynolds, M.A., Professor of Engineering, Owen's College.—Some years ago I was led to consider this somewhat common though striking phenomenon, and at the time I arrived at what seemed to be a perfectly satisfactory explanation of it. I did not then suppose this explanation was new, but as I cannot find that anything like it has been published, I have presumed to take this opportunity of bringing it before the society.

Although every one will have watched with interest the performance of the ball as it is acted on by the jet, and be more or less familiar with it, I shall recount the principal things I noticed whilst observing it critically.

The ball was very light and had a wet surface.

The jet, when free from the ball, would rise about three feet.

The ball was not kept in one position, but oscillated up and down.

The centre was not necessarily over the jet, it often remained for a long time on one side of it. In fact it appeared to be in equilibrium when struck about 45° from its middle.

In this way, for some seconds at a time, the ball appeared as though it were hanging to the jet, and then it would oscillate about this position so far that at times it would be struck underneath, and at other times almost on the horizontal circle; indeed sometimes it would be forced so much to one side that the jet missed it altogether. In this case it would immediately drop down, but such was its determination not to be thrust aside, that it generally came back into the jet almost instantly. Occasionally, however, it would fall down into the basin.

Being a light ball the friction of the water caused it to spin, and as it moved about the jet it would spin sometimes in one direction and sometimes in another, always about a horizontal axis.

Of the water which strikes the ball, part is immediately splashed off in all directions, part is deflected off at a tangent, and part adheres to the ball, and is carried round with it until it is thrown off by centrifugal force.

There are many other things that attract attention, but I think I have noticed those which bear on the explanation.

The vertical force caused by the action of the jet is no doubt amply sufficient to support the weight of the ball, and did the centre of the ball remain vertically over the jet there would be no difficulty. The only explanations I have ever heard have been based on the same supposition: the jet is supposed to strike the ball underneath, and form a cup in which the ball rests.

A few seconds' observation, however, will show that the above is not satisfactory: before any explanation can be complete, it must show how it is that the ball will remain in equilibrium on one side of the jet; nay, that it will fly back into the jet, when driven out of it. I will first point out the nature of the forces which act on the ball. Its weight acts at its centre in a vertical line, and is the only force which is not due to the water. If the water strikes the ball directly underneath its centre, it will produce a force acting upwards in a vertical line, the magnitude of which will depend on the height, and may therefore be made to balance the weight of the ball. In this position the ball would by the action of those two forces be in equilibrium in the same way as if it were balanced on a point; the slightest deviation would upset it, and then the jet would strike it on one side. If so struck there would be two forces at the point of contact, the one normal or through the centre of the ball, due to the impulsive action of the water, which I shall call P; and another in the tangent due to the friction of the water, which I call R.

If W be the weight of the ball, then P, R, and W are the only forces which at first sight appear to exist, and the question is, can P, R, and W be in equilibrium? This is easily answered; for, these three forces are necessarily in the same plane, but they do not all pass through the same point, and therefore they are not in equilibrium. Hence there must be some other force acting on the ball which does not pass through its centre, or the point in which it is struck. Since this force cannot arise from the action of the water as it strikes the ball, or the weight of the ball, it must be due to the action of the water as it leaves, and since that water which is splashed off or deflected at the point of contact does not touch the ball again, the force must be due to the water which adheres to the ball, and is subsequently thrown off.

Now whenever a drop leaves the ball there will be a tangential reaction in a direction opposite to that in which it leaves, and if many drops are leaving the ball at the same time, there will be a force equal to the sum of all their reactions opposing the rotation of the ball, and a force equal to the resultant of all their reactions acting on the centre of the ball. If the water be thrown off equally all round, this latter force will be zero; but if more drops leave in one direction than in another, the resultant force will be opposite to this direction. As this force is essential to the equilibrium of the ball, the question arises, is there any reason why most of the water should leave the ball in one direction? and if so, in which direction will that be? Now the water comes on the ball at p, and as it passes over the top of the ball, the action of gravity or the weight of the water will be to keep it on the ball, but after it has passed the top, the conditions for its leaving become more and more favourable—so that it appears as though the water would begin to leave as soon as it had passed over the top of the ball and go on until it was all thrown off. In this way most of the water would leave between the top of the ball and that side which is opposite the jet, which, on examination, I find to be the case.

It was the discovery of this fact which has enabled me to explain the phenomenon, for this water causes a resultant reaction which is the additional force necessary to maintain the equilibrium of the ball.

Let this resultant reaction be called Q, it will act upwards and towards the jet, and its effect will be, first, to force the ball into the jet and so will help to counteract the obliquity of P; secondly, it will assist in supporting the ball; and thirdly, since it opposes the rotation, it will balance the tangential force R caused by the friction at p, and provided it have the proper magnitude, together with the forces P, R, and W, it is all that is requisite to explain the equilibrium.

Position of Equilibrium.—With regard to the position of the ball when in equilibrium I cannot establish anything definite, as there are no known laws of adhesion, but I can show by general reasoning that there are certain limits between which the point in which the ball is struck must lie, so that there may be equilibrium.

Let the point p be at a fixed height, and let P′ equal the full force of the jet at this height when acting on the bottom of the ball or on a perpendicular plane. Then if a be the angle which the normal at p makes with the vertical

$$P = P' \cos a$$

and the horizontal component

$$P \sin a = \frac{P'}{2} 2 \sin a \cos a = \frac{P'}{2} \sin 2a;$$

therefore

$$P \sin a = \frac{P'}{2} \text{ and is a maximum when } a = 45°$$

and $$P \sin a = 0 \text{ when } a = 0 \text{ or } a = 90°$$

So that the tendency of the jet to force the ball to one side increases from nothing to $\frac{P'}{2}$ as p moves from the bottom to a point at which the normal makes an angle of 45° with the vertical and then decreases to nothing as p moves to the middle of the ball.

The force Q may be fairly assumed to increase as the speed of rotation increases, and this will be as the point of contact moves from the bottom to the middle of the ball. In the same way the force F, which will necessarily increase as Q increases, will increase as p moves from the bottom to the middle of the ball, and its horizontal component will follow nearly the same law as that of P.

Considering then the horizontal forces only, there must be some position for p in which the horizontal component of Q and F will be equal to that of P, and if a horizontal circle be drawn through this point it will limit the part of the ball in which equilibrium is possible.

For any deviation without this circle the equilibrium will be stable, *i.e.* if the centre of the ball gets so far from the jet that the ball is struck in some point without this circle, it will come back again. As to the nature of the equilibrium for any deviation within this circle, I cannot speak positively, but it is probably nearly neutral all over the inclosed area.

This seems to agree very well with the appearances I have described, namely, that the ball appeared to be in equilibrium when struck at a point about 45° from its middle, about which point it oscillates. When the oscillations become so big that the ball leaves the jet, I have said that the ball instantly jumps back again. To account for this we have only to consider that the force P ceases as soon as the contact ceases, but not so with Q, for there will still be some water to be thrown off, so that perhaps for half of a revolution after the contact has ceased, the force Q will continue undiminished and so bring the ball back into the jet.

EAST KENT NATURAL HISTORY SOCIETY, CANTERBURY.

Abstract of Proceedings, 1869.

In March a sub-committee was formed for the purpose of collecting and recording information on the flora of the district, which corresponds to that of the Parliamentary division of the county. Fourteen contributors have combined to carry out the work, and some valuable records have been already obtained. Connected with this point the following notice will be interesting:—Two plants, either new to or rare in the district, have been found and clearly identified,—*Wolffia arrhiza* and *Riccia fluitans*. Wolffia having never before been found in Kent, is now added for the first time to the flora of the county. The discovery of this curious member of the order Lemnaceæ was the more interesting, as it enabled Mr. Gulliver to complete his observations on the distinctive cell-characters between Wolffia and Lemna, as described and figured by him in *Seeman's Journal of Botany*, January, 1869. The Riccia is a pretty muscal cryptogam, and will be found novel and interesting for cultivation in vases of fresh water.

At a meeting at Dover, Mr. Horsnail read a paper on "A Crustacean of the family Pyonogonidæ found in the locality."—This has since been published in *Science-Gossip*. Major Munn also communicated a paper "On the Hexagonal Cells of Wasps and Bees," in which from his own direct observations on the formations of the cells, and the construction of solitary cells in this form, he refuted the "circular theory" of their production.

At Canterbury, the Rev. J. Mitchinson, D.C.L., gave a lecture "On Volcanic Action," chiefly referring to extinct volcanoes, and recording his personal experience and observation in the district of Auvergne.

G. Dowker, Esq., F.G.S., on two occasions described at some length, illustrating his remarks by many excellent diagrams and specimens, "Certain Points in the Geology of the Isle of Thanet."—A brief summary of his observations may be given in the following conclusions:—That the changes during the historical period are due to the alluvial deposits of the Stour river, and the changes in currents in the sea, and not to any elevation of the land. That the Isle of Thanet had been formed in an estuary of the Stour and Wandour rivers. That the drift deposits are of the post-glacial period, cotemporaneous with those of the Thames valley, in which flint implements associated with bones of extinct mammals had been found. A list of these mammals found in East Kent was given. At this period France and Thanet were united, as shown by Trimmer. That the Isle of Thanet is an anticlinal axis of the chalk, the most elevated portion of which was near St. Peter's, in Thanet. A diagram of a section from Minster, in Isle of Sheppy, to Ramsgate, running nearly in the line of the anticlinal, showed this, and also how the Thanet, Woolwich, and Oldhaven beds, with the London clay, had been denuded off the chalk. That the Stour Valley, from Groveferry to Pegwell, is in Thanet beds, lying in the synclinal of the chalk, which reappear at Nonnington and Wingham, on the sides of the valley opposite Thanet. That the junction of the Thanet beds with the chalk was always indicated by the presence of green-coated flints, reposing in most instances on tabular layers of flint. There was not sufficiently well-defined evidence at present as to whether the Thanet beds rest conformably on the chalk; no sufficiently continuous junctions are exhibited to prove whether the same bed of chalk is always present. That the chalk of Pegwell and Margate, destitute of flints, was superior in position to that of Ramsgate, which abounded in flints, the section along the coast thus representing the arch of the anticlinal. The true position of Margate chalk was first pointed out by Mr. Whitaker; the peculiar division in the Margate chalk was due to the right-angled fissures to the planes of bedding becoming weathered out by atmospheric agencies, often leaving projecting headlands. That, as far as the fossils contained in it might be taken as proof, the Margate chalk may be coeval with that of Norwich, and equivalent to the highest chalk in England. A comparison of the fossils was given. That there was no direct evidence of the thickness of the Thanet chalk beyond that afforded by a well sunk at Margate, and which did not penetrate it. The thickness of the upper or Margate chalk in this section appeared to be only 30 ft.; on the other hand there is evidence of great irregularities in the chalk deposit, and these may not be due to denudation, but to unequal deposition over an irregular sea-bed produced by elevation of lower strata.

G. Gulliver, Esq., F.R.S., at Canterbury, described and demonstrated under the microscope the auditory organs of mollusks. These observations were published in the *Journal of Anatomy and Physiology*.

At Dover, in November, a lecture was given by G. Gulliver, Esq., "On the Use of Red Corpuscles of the Blood in Respiration, and the Import of their Size both in a Taxonomic and Physiological Point of View; with an account of his discovery of the Characters afforded by the Blood-disks of Tragulus and Moschus." This lecture was published in Scientific Opinion, vol. ii. p. 588.

Two excursions were made during the year. One in June to explore the district between Ashford and Mersham Hatch: a somewhat distinctive flora associated with the Sandgate and Hythe beds was investigated. The second was a dredging and exploring party from Herne Bay to Reculver in September.

At a meeting held on this occasion, G. Dowker, Esq., F.G.S., read a paper "On Hydroid Zoophytes." Having given a good *résumé* of the present knowledge on the subject, he illustrated the growth and development of these animals by his observations on one which had existed in his marine aquarium for *five* years. It belonged to the family Stauridiidæ, and was figured and described by Hincks as *Cladonema radiatum*. The Gonozooids, or Medusæ, appear in May and September, and protrude from the polypite near its junction with the chitonous receptacle. They grow rapidly and become detached about the third or fourth day. Mr. Dowker gave the following list of Zoophytes that he had either dredged or observed at Herne Bay:—*Bowerbankia imbricata*, *Flustra foliacea*, Lepralia (various species), *Halecium halecinum*, *Notarnia bursaria*.

NEWCASTLE CHEMICAL SOCIETY.

March 24th.—The paper read was "On a New Method of Manufacturing Caustic Soda," patented by M. Bachet, of Paris, with experiments, by R. Calvert Clapham, F.C.S.—Experiments were made by Lord Dundonald as far back as 1790-1794, in making caustic soda by the decomposition of common salt with litharge. This process was conducted on a manufacturing scale by the late Mr. Wm. Losh, in 1799, and I am indebted to him for some details of the process then in operation.

The proportions recommended to produce the best results were 100 parts of salt and 300 parts of oxide of lead; but when the greatest care was taken, they did not succeed in obtaining more than 3·0 parts of caustic soda, or 5·6 per cent of salt was decomposed. At that time they had many difficulties to contend with, in preventing the loss of lead in the solutions, and they had no plan in operation to reconvert the white-lead pigment which was formed back again into an oxide of lead ready to receive a fresh charge of salt. They had, therefore, to contend with considerable expenses, and some loss of lead in melting it down again to a metallic state. It was only the high price of soda, which may be calculated as equal to £85 to £90 per ton of 70 per cent. caustic soda, which enabled the operations to be conducted at a profit. I shall not trouble the members with any details of the changes which have taken place in the manufacture of soda from that time to the present. It is sufficient to say, that after three-quarters of a century has passed away, a patent has been taken out by M. Bachet, of Paris, for the production of caustic soda by means of salt and litharge,

which, in some respects, resembles the old method, but with this marked difference, that hydrate of lime is added to the mixture, which has the effect of preventing the reactions which take place between the soda and the chloride of lead, by the old method, resulting in the re-conversion of the chloride of lead into common salt; and the new process also includes a method of regenerating the white lead pigment, so that it may be used over and over again.

YORKSHIRE NATURALISTS' CLUB.

THE usual monthly meeting of this club was held on Wednesday, April 6, at Mr. Graham's, Market-street, York, S. W. North, Esq., in the chair.

Mr. C. Wakefield, the honorary secretary, remarked that the proceedings of the club for the past year, copies of which were laid upon the table, were now ready and would be forwarded to the members in a few days. He also announced that subscriptions from the president and members, amounting to £5. 10s., had been collected towards a general fund which is being raised for the family of Professor Michael Sars, of Christiania, which has been left in a destitute state by his unexpected demise. This sum will be shortly forwarded to London by Mr. North, who has kindly acted as treasurer.

Mr. Graham exhibited a remarkably fine pike, weighing upwards of 20lb., and sent to him for preservation by J. Hope Barton, Esq., of Stapleton Park, Pontefract; two fine male specimens of the Gargany ducks (*Anas querquedula*), one sent by Col. Wade, of Hauxwell Hall, Bedale, the other, by M. H. Horsfall, Esq., and a remarkably fine specimen of the common heron (*Ardea cinerea*), sent to him by Mr. J. Chapman, of Mennithorpe, near Howden.

The Rev. J. F. Blake, F.G.S., exhibited a full-grown specimen of *Ammonites heterophyllus*, which characterizes the uppermost beds of the lias at Whitby. It was remarkable for the preservation of its body chamber, portions of which, detached from the ammonite are not uncommon, and are known by the name of the fan, but he had never seen a complete specimen of this kind figured. He observed that the last chamber had a different appearance from the rest; it was in this part that the animal lived, and it was a common feature in ammonites, were found perfect, to present some peculiarities in this part—some form projecting lips, some greatly expand, some have differences in the keel, and, as in this case, some have extra ornamentation. Of the life-history of this ammonite we know as much as of any, as they are found from a very small size up to that of the present; but it is only when of the largest size that this altered last chamber appears, small "fans" being unknown.

Mr. J. F. Walker, F.G.S., made some remarks on the Gravel Pit, at Nunthorpe, near the city, in which, he said, were found boulders of carboniferous limestone, containing crinoids and masses of coral, sandstones derived from the coal-measures containing casts of shells, chiefly brachiopoda, stems of lepidodendron, and waterworn specimens of *Gryphæa incurva*, from the lias. Bones of mammals have occasionally been met with in this pit, also a boulder from Shapfell. Below this gravel there is a thick bed of sand containing a thin seam of clay. Mr. Walker's attention had been directed to the discovery of several large boulders in a field on this side of Holgate. On visiting it he found several large stones composed of micaceous sandstone, the largest of which was irregular in shape, and measured 3 ft. 6in. in length, 2 ft. 8in. broad, and 1 ft. 3in. deep. This stone was found 3 ft. below the surface in a dark blue and brown variegated clay, containing numerous stones marked with the glacial striæ. This bed of clay extends down to the beck, and above it is a mixture of sand and gravel. In conclusion Mr. Walker ventured to regard the clay at Holgate as an outlyer of the true boulder clay, whilst the other beds have afterwards been deposited at the sides of it.

Mr. Walker exhibited a fine specimen of *Terebratula Bentleyii* from the cornbrash of Yanley, near Peterborough.

At the conclusion of Mr. Walker's paper a discussion followed, in which Messrs. North, Fox, and Strangeways, took part, the secretary remarking that bones of the mammoth, and *Gryphæa incurva* had previously been found as far west as Heslington.

THE WINCHESTER AND HAMPSHIRE SCIENTIFIC SOCIETY.

A MONTHLY meeting of this society was held at the studio of Mr. Savage, Southgate-road, last month. The president (Rev. C. A. Johns) occupied the chair. There was a good attendance of members, who experienced an unexpected treat in hearing from Canon Kingsley a glowing description of the primeval forests of Trinidad, whence the rev. gentleman has recently returned. The following proposed members were balloted for, and elected into the society:—Revs. J. T. Bramston and J. L. Barton, and Messrs. Chas. Wooldridge, sen., W. Oakshott, G. H. Pointer, and W. Barter. The secretary (Mr. A. Angell, jun.) having read the minutes of the previous meeting,

The president said it was proposed to form a sub-committee for botanical studies, each person making collections and interchanging their specimens. He invited those who wished to join to give in their names. The chairman afterwards stated that Dr. Richards had presented an excellent collection of dried grasses to the society, and intimated that the same would form a nucleus to which the sub-committee might add the results of their labours. He also drew attention to the interesting specimens of seeds from the West Indies, placed on the table by Canon Kingsley. With reference to the "report of the sub-committee of inquiry with regard to Hyde Abbey as the burying-place of King Alfred," the president called on

Mr. Collier, who said that recent information obtained by the sub-committee almost made the reading of the report unnecessary and a waste of time. The meeting, however, desired to hear it, and it was therefore read.

EDINBURGH BOTANICAL SOCIETY.

THIS society met March 10th, Sir Walter Elliot, president, in the chair. Donations to the library, herbarium, and museum were announced. Professor Balfour noticed the death of Professor Franz Xavier Unger, M.D., which took place suddenly at Gratz, on 13th February. He was one of the twenty-five foreign honorary fellows of the society.

Mr. Sadler noticed the death of Dr. Alexander Carroll Maingay, who joined the society on 8th February, 1855. He was engaged in investigating the flora of Burmah.

The following communications were read:—

"On the Formation of a Museum of Vegetable Materia Medica," by William Craig, M.B. and C.M.—While admitting the great value of the Materia Medica collection in the university, the author thought that it would be well if the society would assist in forming a museum to illustrate completely the British Pharmacopœia, by means of herbarium and laboratory specimens.

"On the Fructification of *Griffithsia corallina*, with a notice of the other Algæ found in Shetland, not mentioned in Edmonston's Flora," by C. W. Peach, A.L.S.

"On Two New British Hepaticæ," by Dr. B. Carrington.—The plants referred to by Dr. Carrington were—*Nardia sphacelata* (Carr) and *Adelanthus Carringtonii* (Balfour).

"On the Occurrence of *Luzula arcuata* and *Buxbaumia indusiata*, in Inverness-shire," by Dr. Buchanan White.

"On some recent Additions made to the Flora of Canada," by Mr. Sadler.

"Report on the Open-air Vegetation at the Royal Botanic Garden," by Mr. M'Nab.—The author remarked that the six lowest morning readings since 10th February were on the mornings of 13th, 22nd, 25th, 26th, and 27th February, also on 6th March, marking respectively 26°, 26°, 15°, 26°, 20°, and 27°; and the six highest morning temperatures during the same period were on the 16th, 17th, and 21st February, also on 1st, 2nd, and 3rd, of March, indicating respectively 34°, 34°, 33°, 43°, 34°, and 34°. These low temperatures have retarded vegetation considerably. At this date there were only ten species of spring plants in bloom, independently of the two formerly noticed; while at the March meeting last year no less than forty-three species were recorded. The number this March is only twelve, including those noticed at the January and February meetings.

	Date of Flowering. 1870.	1869.
Corylus avellana	Feb. 18	Jan. 14
Nordmannia cordifolia	Feb. 19	Jan. 21
Eranthis hyemalis	Feb. 20	Jan. 16
Jasminum nudiflorum	Feb. 20	Jan. 13
Garrya elliptica	Feb. 24	Jan. 14
Crocus susianus	Mar. 1	Jan. 22
Leucojum vernum	Mar. 2	Jan. 17
Crocus vernus and *vars.*	Mar. 3	Jan. 13
Galanthus plicatus	Mar. 4	Jan. 26
Hepatica triloba	Mar. 5	Jan. 23

Miscellaneous communications were received—from Professor Dickson, Glasgow (demonstrating some of the stages in the development of the embryo of *Zostera marina*, and pointing out the light that was thrown by this embryo on that of grasses); from Miss Beaver, of Coniston; from Mr. M'Nab, Mr. Sadler (who sent a specimen of Guarana), Sir Wm. Jardine, Bart., Don Guiliermo Jameson, San Juan (who presented a large collection of dried plants from the Andes), and from Mr. Mawson.

GLASGOW NATURAL HISTORY SOCIETY.

THE seventh meeting of the session was held on the evening of Tuesday, the 29th ult., in the library of Anderson's University, Professor John Young, M.D., president, occupying the chair. Messrs. James Lumsden, 194, Bath-street, and David M. Lyle, 147, Stockwell-street, were elected resident members.

The following objects were exhibited at this meeting :—

1. Skulls of the male and female of the Gaur, or Indian Bison (*Gavæus Gaurus*) forwarded, with remarks, by Captain H. W. Fielden, 4th King's Own Royal Regiment, corresponding member. Also, a very fine head of the Cape Buffalo (*Bubalus Caffer*), lent for the occasion by the Messrs. Yuill, taxidermists, Sauchiehall-street.

2. A collection of fossil Brachiopoda, from the Silurian beds of the Girvan valley, Ayrshire, including several new species, by Mr. John Young. This interesting series, which had been collected last summer by Mrs. Robert Gray, had already been submitted to Mr. Thomas Davidson, of Brighton, who intends figuring and describing the newly discovered forms in the general supplement to his well-known work on fossil Brachiopoda. Mr. Young, in exhibiting these, referred especially to the following genera and species:—*Rhynchonella Weaveri* (Salter), *R. æmula* (Salter), *R. Thomsoni*, *Atrypa incerta*, *Triplesia Grayi*, *Orthis elegantula*, *O. calligramma*, var. *Scotica*, *O. Bouchardi*, and another interesting form of Orthis, not yet named; *Strophomena imbrex*, var. *semiglobosa*, *S. Grayi* (a new species not yet published), *Leptæna transversalis*, var. *Youngiana*, *L. sericea*, and *L. tenuicincta*. Mr. Young also stated to the meeting that the collection made by Mrs. Gray was equally important as regarded other shells—the trilobites, corals, graptolites, &c.,—the whole consisting of several thousand well-selected specimens, which would probably yield a number of new species when they came to be thoroughly examined.

3. The secretary exhibited a specimen of the Crested Spizaëtus (*Spizaëtus cristatellus*, Jardine and Selby)—a rare bird in collections—which had been lent by Mr. J. Whiteford, Wilson-street. This specimen was brought from Demerara, and Mr. Gray remarked that little appeared to be known of its habits.

4. Dr. John Grieve and Mr. J. A. Mahony exhibited a series of fossils from the leaf-beds in Mull, on which Dr. Grieve made some remarks. Dr. Grieve also exhibited specimens of *Hymeniacidon suberea* and *Nebalia bipes*, both from Rothsay, and a collection of Amphipods from Gourock, embracing upwards of twenty interesting species.

The following papers were then read :—

"On the Shell Mounds at the Machar Grogary, South Uist," by James A. Mahony, Esq.—This paper was illustrated by a large collection of objects, chiefly shells of various kinds, bones of a number of animals, some of them drilled with holes, others split longitudinally, stone knives or scrapers, pieces of rude pottery, and other articles of a like nature, usually found in these refuse heaps. At the close of the paper, Professor Young dwelt at some length in comparing these mounds of Western Scotland with what had been examined in the eastern counties, especially in Caithness.

"On the Sea Anemones of the Shores of the Cumbraes," by David Robertson, Esq., F.G.S.—The author gave a complete list of the species taken by himself in that most interesting locality, and exhibited several living anemones in illustration of his paper.

Several important donations to the library were then announced, after which the meeting was adjourned till the last Tuesday in April.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, APRIL 4TH.—The correspondence, which was extensive, was presented by M. Dumas.

In a note by M. Viollet the nature of the annular deposit was described, which is nearly always to be seen in the tubes used for condensation in organic analyses. He states it to be due to the selenium which is present in most coppers of commerce.

According to a note from M. Royer he has succeeded in transforming carbonic acid into formic acid by *intrapillary* force.

Another memoir was received from M. Dubrunfaut, the object of which is to furnish further proofs of the fact already pointed out by him in preceding communications, namely, the existence of water in all gases after apparently the most complete desiccation. The driest atmospheric air still contains 0·0005 per 1000.

Several notes from different persons were on the ventilation of hospitals, and on the proper means of rendering harmless to the public health the air which escapes from the rooms and spreads through the atmosphere.

Experiments made with the sewage of Paris to fertilize the sandy plain of Gennevilliers, formed the subject of a note. From this it appears that these lands have been rendered so far fruitful that certain exceptional crops have been made to flourish.

The report of the meteorological observatory of Montsouris for March was presented by M. Charles Sainte Claire-Deville, who entered into some of its details, showing that this establishment is in full activity.

M. Jamin, returning to his communication at the last meeting, made known an interesting result to which he had been led through applying the formula he had established to the correction of the number given by Laplace and Lavoisier for the latent heat of ice. This number, which is 75 calories, was corrected by MM. La Provostaye and Desains, who found, by their experiments, 79·25. M. Regnault also arrived at almost the same number. On making the necessary correction of Laplace and Lavoisier's number, according to his formula, M. Jamin has obtained the number 79·40 so that the experiments of Lavoisier were well made, only their interpretation was erroneous.

A report by M. Bouley was then read on the official documents relating to hydrophobia, which the different municipal administrations of France have been invited to collect together and publish annually.

M. H. Sainte Claire-Deville presented a note by M. E. Lefebvre, on the supersaturation of solutions of calcium chloride. Such a solution is readily obtained even in the open air. Most salts fail to make it crystallize, but crystals of calcium chloride itself and of strontium chloride, and barium chloride, bring about this crystallization. A solution containing about 55 per cent. of anhydrous salt, deposits large tubular crystals having the composition $CaCl_2,4OH_2$ quite different from the prismatic crystals, having the composition $CaCl_2,6OH_2$.

NOTES AND MEMORANDA.

The Channel Bridge.—Before the Easter holidays a large foot bridge of more than 130 yards (100 mètres) span, and constructed precisely on the system, and to the exact scale, of the proposed Channel Bridge, will have been completed by M. Boutet, so that whatever doubts may hitherto have existed as to the practicability of the invention must henceforth be dispelled. The two abutments, formed of enormous blocks of granite, are ready for putting in place, and the tress and platform are set up for a length of 80 mètres (the ground at disposal at the Dépôt des Marbres not allowing of the whole length being extended). On Thursday the French Minister of Fine Arts, M. Richard, visited the works for the purpose of inspecting the progress of the model, and expressed himself perfectly satisfied, announcing his determination to renew his visit as soon as it shall have been completed. The tress was thoroughly tested, and resisted without the slightest deflection a strain double that of the testing weight required by the rules of the "Ponts et Chaussées." This model will be exactly one-tenth of the span proposed for the Channel Bridge, and being five times the size of the last model it will, if successful, furnish an excellent illustration of the capabilities of M. Boutet's system. It may be mentioned that Mr. Page, the engineer of Westminster Bridge, when last week discussing at the Society of Arts the merits of the different projects for crossing the Channel, gave M. Boutet's bridge the second place among them, mentioning very strong reasons against all the other projects, except his own, to which he naturally assigned the first place, and stating of M. Boutet's project that he thought a permanent bridge could be established, that there is no insuperable difficulty in erecting piers in the deepest part of the Channel, and that the plan of M. Boutet for the superstructure was calculated, to a great extent, to produce the necessary span. The span of the great foot bridge, now being completed, is larger by a third than the longest spans of the ordinary and foot bridges of Paris, that of the Buttes-Chaumont included, and the testing of it will not only increase the confidence in M. Boutet's ability to construct a Channel Bridge, but secure a continuance of orders for the immediate application of the system for bridges and viaducts on the larger scale. As no necessity exists for the construction and placing of piers, the usual soundings, and other preparatory submarine works (which in the construction of bridges by other means absorb three-fourths of the expense) can be completely avoided. The favour with which M. Boutet's bridges are being received is not, therefore, astonishing, and it is gratifying to recognize that the success predicted for them at the very outset is being so completely realized.

A Steam-Engine without a Crank.—The engine is very simple, and consists of a cylinder 12 in. long and 6¼ in. bore (in the one already built), with the shaft passing through the centre of it. The cylinder is furnished with a piston at each end, precisely like the pistons of common crank engines; to these pistons are connected short rods, with a friction roller at the outside end working in the inside of an elliptical ring, which passes around the shaft outside of the cylinder; outside of the ellipse is another friction roller, connected to the piston by compensating levers in such a manner that when the pistons are moving towards the centre of the cylinder, the rollers act on opposite sides of the ellipse, both pulling directly towards the centre, thus causing them to move forward on the ellipse, and communicating a rotary motion to the shaft. After the rollers have passed forward to the shortest diameter of the ellipse, the steam is exhausted from the ends of the cylinder and let into the middle, between the pistons,

pressing them outward, causing the rollers in the ends of the piston rods to act on the inside of the ellipse, and continuing the forward motion of the shaft until they arrive at the long diameter, when the steam is exhausted from the middle of the cylinder, and is again applied at the ends. The results obtained were surprising, and can hardly be credited by believers in the infallibility of the crank motion. The cylinder is about the size of the cylinder of an eight-horse crank engine, with a stroke of 3 in. for each piston, and the power evolved was at least 22-horse power, and some present at the trial placed it as high as 25-horse power, with a speed of 100 revolutions per minute, and 50 lb. of steam, consuming about the amount of fuel required for a 10-horse engine.—*Daily Milwaukee News.*

Diminution of Weight in Man during the Cold Months.—Mr. Milner, of Wakefield (*Am. Jour. of Med. Sciences*), some years since performed a series of experiments with a view of determining the periodical fluctuations in weight, substance, and form, which the whole body undergoes. He weighed every prisoner upon his entrance into the convict establishment at Wakefield, and subsequently at the end of every calendar month, all of them being subjected to similar conditions of temperature, food, exercise, and ventilation. The number of men weighed exceeded 4,000, and the total number of individual weighings was 44,004. From his experiments it was found that there was a progressive loss of weight in January, February, and March, and a gain in April, May, June, July, and August, and a loss in September, October, November, and December; or, in other words, an increase of weight during the hot months, and a diminution during the cold. These results are in accordance with physiological truth, for Dr. E. Smith has shown that the quantity of carbonic acid exhaled in winter is largely in excess of that given out in summer, and the sudden weight in April is found to correspond with an equally abrupt diminution in the quantity of carbonic acid expired.

Cutaneous Absorption.—M. Brémond of Vincennes, in a lecture delivered at a late *séance* of the Academy of Medicine, states that he believes he has irrefragably proved the occurrence of absorption by the skin of a medicinal substance, even when this is not volatile, as in the case of iodide of potassium. In a first series of experiments he exposed the skin to the action of a vapour bath charged with salt, gradually raised to a temperature of 113° F., for half an hour. Two hours afterwards iodide of potassium was observed in the urine, though it could only have entered by the skin. In a second series of experiments he found that no absorption ordinarily occurs unless the temperature of the vapour bath exceeds the normal heat of the body by at least one or two degrees, and the exposure have lasted for at least half a minute. Whilst in a third series he states, as the result he has obtained, that even at 95° F., absorption may occur, provided the body have previously been exposed to the action of a vapour bath, and afterwards vigorously soaped and rubbed, by which means all the oily material is removed. These experiments explain the different results that have been obtained by various observers.

Deep-Sea Life and Taxation—I will state what I believe to be the true principle of taxation, and will illustrate it by what is in Dr. Carpenter's recent voyage in the Arctic Ocean. He states that they found the frailest and smallest animals living and flourishing at the bottom of the sea under a pressure of three tons to the square inch. How did they contrive to live? Because the pressure was equalized. And that is the whole secret of taxation.—*Report of Mr. Lowe's Speech on the Budget.*

SCIENTIFIC DIARY.

WEDNESDAY, April 13th.

Geological Society, 8 p.m. "On the Fossil Remains of Mammals found in China," by Prof. Owen, F.R.S., F.G.S. "Further Discovery of the Fossil Elephants of Malta," by Dr. A. A. Caruana; communicated by Dr. A. Leith Adams, F.G.S. "Brief preliminary Notes on a large Coal-measure Reptile from the Low Main Coal Shale," by T. P. Barkas, Esq., F.G.S.
Graphic Society, 8 p.m.
Royal Microscopical Society, 8 p.m. "On the Colouring Matter derived from the Decomposition of some Minute Organisms," by Mr. H. C. Sorby.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.
Epidemiological Society, 8 p.m. "On mixed Outbreaks of Variola, Varioloid, and Varicella," by Dr. Gavin Milroy.
Hunterian Society, 8 p.m.
Glasgow Philosophical Society, 8 p.m. "On the Definition of a 'Formation' in Geology," by Prof. Young. "On the Structural Characteristics of the different Species of Megalichthys," by Mr. J. Thomson. "Note on China Grass (*Boehmeria nivea*) for the preparation of which by suitable machinery, the Government of India offers a Prize of £5,000," by Mr. W. Keddie.

THURSDAY, 14th.

London Institution, 7·30 p.m.
Mathematical Society, 8 p.m.

MONDAY, 18th.

Victoria Institute, 8 p.m. "True Anthropology; or, the Spiritual, Mental, and Physical Constitution of Man," by W. Hitchman, Esq., M.D.
Asiatic Society, 3 p.m.
Torquay Natural History Society, noon. "On the Geology of Devonshire," by W. Pengelley, Esq., F.R.S.

TUESDAY, 19th.

Institution of Civil Engineers, 8 p.m.
Statistical Society, 8 p.m.
Pathological Society, 8 p.m.
Anthropological Society, 8 p.m. "On Mr. Darwin's Hypothesis of Pangenesis applied to the Faculty of Memory," by Alfred Sanders, Esq. "On Consanguineous Marriages," by G. C. Thompson, Esq.
Leeds Philosophical and Literary Society, 7.30 p.m. "On the Modes of Sepulture employed by the Romans, Romanized Britons, and Anglo-Saxons, from the 4th to the 5th Centuries in England," by Prof. Rolleston, M.D., F.R.S.
Manchester Literary and Philosophical Society, 7 p.m. Annual Meeting.

WEDNESDAY, 20th.

Royal Society of Literature, 4.15 p.m. Anniversary Meeting.
Meteorological Society, 7 p.m.
Society of Arts, 8 p.m.
Glasgow Philosophical Society, 8 p.m. "On Houses for the Reclamation of Young Women," by Mr. William Walker.

HOMŒOPATHY.—The letter of "Ignoramus" is one hardly suited to the columns of a purely scientific journal like ours. He has no doubt detected an imposture, which he might find one of the medical papers glad to insert.

ANNUAL INTERNATIONAL EXHIBITIONS.—We have attended to Lieut.-Col. Scott's inclosure.

DIFFERENTIAL THERMOMETER.—"L. S." is evidently not aware that a modification in Leslie's thermometer has been made by Dr. Mathiessen, which removes this inconvenience. It consists of a cross tube, connecting the two arms, which is provided with a stopcock. By opening this the level of the spirit can be readily adjusted. We are sure that Dr. Mathiessen would let "L. S." see the instrument at the laboratory of St. Bartholomew's Hospital.

SIR W. THOMSON *v.* GEOLOGY.—Mr. Menteath's letter appears in another column.

THE THEORY OF DEW.—Mr. Hudson will find that both parts of his letter have been attended to.

AMPHIOSAURUS.—Mr. Barkas's letter shall appear next week.

NOTICES.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

Subscribers to SCIENTIFIC OPINION are informed that they can procure of the Publishers direct, or through their local Bookseller, neat cloth Cases for Binding Volumes I. and II. of this periodical, price 2s. each.

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THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, APRIL 20, 1870.

SCIENTIFIC CONVERSAZIONI.

THE scientific soirée season has commenced. The Royal Society's evening has already "passed off," and to-night the Royal Microscopical Society, under the presidency of the Rev. J. B. Reade, F.R.S., gives its usual annual conversazione. The occasion is one on which we may offer a few remarks as to the nature and purpose of these gatherings, and as to the manner in which, in London at least, they are generally conducted. The conversazione of the scientific world is really a sort of "kettledrum," at which the *savants* gossip about the work done during the year—the papers read, the discoveries made, the new methods of research projected, and so forth; and just as in the "drum" of the fashionable world, the "tea-kettle" is called into requisition, and the cup which cheers but not inebriates prevails, too often in a condition of doleful weakness and high temperature. But such is a scientific soirée. Honest but quiet workers from the country and over-taxed labourers from the metropolis meet together, and chat friendlily over the progress made during the year in their several departments; and the men of great name meet the men of no name, who merely knew them by their reputation; and thus a general bond of union is established among scientific investigators, and good fellowship is in some measure promoted. But there is something besides the tea and the guests. There is a display of scientific objects, and, in some instances also, a display of dress and fair faces; and it is to these additional characteristics of the modern scientific soirée that we wish more expressly to direct attention.

As Conversazioni are now managed in London, you might go to one, and nevertheless, for all practical purposes, you would see all. This will certainly appear strange to our country cousins, but it is nevertheless the plain truth. The fact is that, in so far as the exhibition of scientific objects is concerned, the scientific soirées of London are the merest farces and the dullest entertainments in the world. The whole affair is, in great measure, a trade matter; and it is on this account that such gatherings are *de facto* a failure, and that they are so badly attended by really scientific men. Let us in imagination walk through the well-lighted and highly-crowded rooms of one of the metropolitan scientific institutions or colleges, and what shall we find? We shall find a number of objects which, as it were, are stereotyped for soirées, so that we shall "look upon their like" at every similar gathering for the next ten years. And what shall we see? Well, here as we enter the room we shall see a table with a number of polariscopes and a few gorgeous selenite objects exhibited in them. On the next table stand a selection of surgical apparatus, including a sphygmograph and one of Dr. Richardson's apparatus for local anæsthesia. Further on a table of microscopes; and what see we here?—a fly's proboscis (we know that proboscis almost as well as Mr. Lowne, we have seen it so often), a few common foraminifera and polycistins, a beetle's eye, the heart of a planorbis, and, of course, the frog's foot. We saw these ten years ago, and we shall, we fear, have to see them ten years hence. But let us go on; at another table electricity is represented—but do we find the least indication of any of the great discoveries of the year? Not one. There are batteries and huge induction coils, which keep giving off sparks of fabulous length, and maintain a noise like the successive discharges of a line of skirmishers on a field-day. Then there are vacuum-tubes with marvellous colours, and of such fantastic shapes that one is puzzled, till the programme enlightens one, as to what they are intended to represent. Then again in other *salons* there are spectroscopes and photographs, and many other examples of Science applied to manufactures, and exhibited in the interest of manufacturers.

To all this we object, and we do so on the ground that it in no way represents the scientific progress of the age; indeed, if we would be candid, we must say that the scientific soirée of these times is but an evening spent in the extemporized showrooms of the London instrument-makers. This is not as it should be, and it results from the excessive commercial energy of the makers of apparatus, and the excessive supineness of the Fellows of the Scientific Societies, who take no trouble to exhibit any of the fruits of their year's labours. But assuredly some faint improvement should be attempted, and something should be done to rescue the representation of modern scientific progress from the hands of a few traders in scientific apparatus. We wish to pass no slur on the makers. To the best of their ability, and with commendable ingenuity and trouble, they have done the work of the London soirées for many years. So far we thank them; and we think that at such gatherings they should always have a place where they might display any novelties, either in invention or application, that they have constructed during the year. But to allow them the monopoly is simply to make Science ridiculous and unattractive.

We believe we are not incorrect in stating that the absurdity of the existing state of things has been recognized by the Royal Microscopical Society, and that this evening's conversazione will be something quite out of the common, in so far as it will really to some extent represent the chief discoveries and advances made in Microscopy during the past twelvemonths. It is intended that the objects placed under the multitude of microscopes which will be seen to-night at King's College shall be representative of the labours of the year, and they will be accompanied by a *catalogue raisonnée*, prepared at considerable pains by one of the members of the Council, who has realized the effeteness of the old system of soirées. This step forwards is a very great one; and though, owing to its being the first one, it may not reach complete success, it is one on which the Royal Microscopical Society deserves to be warmly congratulated, inasmuch as that body has been the first to rouse the Scientific Societies from the state of lethargy into which, in this respect, they were fast subsiding. No doubt, once the movement has commenced, it will soon be shared in by the other scientific bodies and schools of the metropolis; and we may hope that, ere long, a scientific conversazione will be what it certainly has not been for many years—really "worth going to."

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

IN the preliminary report of the Committee on Gunpowder and Explosive Substances, it is stated that sufficient progress has been made to prove that there is no difficulty in producing a description of powder much better suited for guns of large calibre than the present service powder. The committee have subjected a large number of descriptions of powder to comparative experiments, including our own service powders of different natures, both Government and contract make, the pellet powder provisionally adopted for large guns, Russian and Prussian prismatic powders, Belgian, French, Spanish, and American powders, together with many descriptions of experimental powder. In investigating the action of these various powders, they have devoted themselves to determining, by Captain Andrew Noble's chronoscope, the time a projectile took to traverse various intervals within the bore of a gun, and to determining directly, by Rodman's pressure-gauge and their own crusher, the pressure upon the gun. The powders

have been analyzed, and their densities have been carefully determined, so that the results obtained with them might be traced to the influence exerted by their relative chemical and physical characters. The "crusher-gauges" used by the committee consist of a number of steel plugs screwed into the gun from breech to muzzle, each containing a small solid copper cylinder, resting against an anvil fixed in the plug, while a movable piston rests against the end of the copper. They act thus. When the charge is fired the gas presses on the piston, and crushes the copper cylinder against the anvil. A testing machine shows what force it required to effect any given compression, and so the amount of compression sustained by the copper becomes a direct indication of the pressure of the gas. The committee found this "crusher" far more accurate than the "Rodman gauge," in which a knife is driven into a copper plate. By means of these instruments the committee have been enabled to construct time-curves and velocity-curves, showing the motion of a projectile in the bore of the gun with various kinds of powder and pressure-curves, and showing the strain of each kind of powder on the various parts of the gun; a result never before attained with any real accuracy. They have ascertained by these experiments that, in the 8-in. gun with which their experiments have been conducted, a description of powder known by them as "Pebble powder, No. 5" gives, when compared with R.L.G. service powder, the following remarkable results:—

Charge.	Muzzle velocity, per second.	Maximum pressure, per square inch.
R. L. G..... 30 lb.	..... 1,324 ft.	..... 29·8 tons.
Pebble, No. 5 ... 35 lb.	..... 1,374 ft.	..... 15·4 tons.

In other words, a charge of 35 lb. of pebble powder gives 50 ft. more velocity to the projectile on leaving the gun than a charge of 30 lb. R. L. G. service powder; yet exerts only about half the strain upon the gun. The advantages of this it is impossible to overrate, especially as the advantage in velocity (which alone could be tested) was fully maintained when battering charges were fired with the two descriptions of powder from a 10-in. gun under proof with 400 lb. projectiles. In the first place, there is the immense advantage that while maintaining and even increasing the present velocity of our projectiles for battering purposes, the use of pebble powder "will materially reduce the initial strain exerted by the exploding charge, thereby prolonging the gun and diminishing the risk of accident." In the next place, it "appears likely that the reduction in violence of explosion effected by the use of such a powder will diminish the liability of projectiles breaking up in the gun, and also modify the scoring action of the gas upon the surface of the bore;" and, last not least, "there is a probability that another important advantage will be secured, namely, the attainment with safety of a considerable increment in velocity with heavy guns, whereby a material increase will be effected in the power of our armaments."

Professor Curtius has been appointed Director-General of the Berlin Museums.

According to the *Athenæum* there is a talk of restoring the University of Olmütz.

An excellent elementary work on Botany with reference to Farming, by Professor Cave, has just been published in Paris.

At the International Maritime Exhibition, to be held at Naples from the 1st September to 30th November, 1870, the objects to be exhibited will be materials for naval construction, steam-engines and fuel, specimens of woods and metals, armament, rigging materials, cordage, clothing and food, implements, instruments and appliances of every kind connected with the construction and navigation of ships, apparatus for saving life and property from ships wrecked and in distress, fishing vessels, gear and tackle, lighthouses, buoys and beacons, dock pontoons, &c. The Committee consists of Baron Heath, F.R.S., Consul-General for Italy, President; Sir Louis Mallet, C.B.; Thomas Gray, Esq.; Captain W. A. J. Heath, R.N.; Sir W. G. Armstrong, C.E., C.B., F.R.S.; John Penn, Esq.; Edwin Clark, Esq., C.E.; Joshua Field, Esq., C.E.; Captain A. Albini, Royal Italian Navy; Arthur R. Acton, Esq., Honorary Secretary. All communications are to be addressed to the Honorary Secretary, at the offices of the Italian Maritime Exhibition, 41, Parliament-street, London, S.W.

The Professorship of Mathematics in the University of London will become vacant at the end of the present session in consequence of the resignation of Professor Hirst.

It is stated in the *Panama Mail* that much damage has been done in the vicinity of Quito, in the province of Imbabura, and in many other places, by earthquakes. On the 2nd of December several shocks were felt, and on the 12th continued shocks were felt from noon till morning of next day, when a shock of extraordinary violence occurred. During the latter part of the day thirteen distinct shocks were felt in Jipijapa, each one being accompanied by a violent windstorm. On the 13th December another terrific shock was experienced. Several times since many shocks have taken place, but none created great alarm until the 2nd March, when there was one of unusual severity at about midday; but the most terrifying one of all took place on the 3rd, when between Pedernals and Cabo Pasado the earth was seen to open and emit a hillock of stones from 30 to 40 ft. high. Behind or near the spot where this occurred stood an earth hill about 60 ft. high, which suddenly and entirely disappeared. Around the base of the hillock is a circular pond of salt water, and for a long distance surrounding that the earth, which before was hard and solid, has become soft and spongy.

Professor Magnus, the celebrated physicist and chemist, died on the 5th inst. His most recent researches were those on radiant heat. These led him, as many of our readers will recollect, to differ from Professor Tyndall's conclusion as to the absorption of radiant heat by aqueous vapour. He attended the last meeting of the British Association at Exeter.

Professor C. F. Hartt, of Cornell University, who has for several years been studying the geology of the coast region of Brazil is preparing, according to the *American Naturalist*, to make another trip to Brazil next summer. He will take with him several students from Cornell University, and the expedition will be one that in its results will, we doubt not, do credit to that institution which has already done so much in introducing full courses of scientific studies into college curriculums. Professor Hartt proposes to study especially the Amazonian drift.

In a letter to the *Times* upon Dr. Tyndall's germ-theory of disease, Dr. Bastian states that, from his investigations he has come to the conclusion that organisms were to be met with in hermetically sealed vessels from which all air had been removed, and after the contained fluids had been raised to a very high temperature. He and Dr. Frankland have placed solutions containing organic matter and other ingredients in flasks, exhausted the flasks of the air they contained, by means of Sprengel's pump, and then hermetically sealed the drawn-out necks of the flasks in the blow-pipe flame. The airless flasks containing then the fluid itself, as the only possible germ-containing material, were submitted in a suitable apparatus by Professor Frankland to a temperature varying from 148° C. to 152° C. for four hours, and yet after having been placed under the influence of suitable conditions, in the course of a few weeks living organisms—many of them altogether new and strange—were found in these fluids. He abstains from mentioning all details as to the nature of the materials used, and many interesting facts observed by him in his experiments, as he hopes soon to lay a full account of his researches on the subject before the Royal Society.

Mr. T. T. Cooper, the explorer, has arrived in Calcutta. He has been baffled in his endeavours to penetrate Thibet and China by passing from Calcutta to Bathang, *viâ* the Brahmapootra and Mishmee country, and has given up the attempt, at least for the present.

From an examination of some vertebræ in the British Museum, Mr. H. G. Seeley has been led to infer the existence of a new order of animals, which will be found to bridge over something of the interval between birds and pterodactyles. He considers these vertebræ to have belonged to a gigantic animal, which he has named *Ornithopsis Hulkei*. His description of it will be found in the current number of the *Annals of Natural History*.

The consumption of horseflesh in Paris as human food seems to be steadily and rapidly increasing. During the past year 2,758 horses were used for this purpose, which is 337 more than in the previous year.

The Senatus of the University of Edinburgh have confirmed Professor Crum-Brown's award of the scholarship in chemistry. While, however, refusing this to Miss Pechey, they have decided that she is entitled to exactly the same certificates as those granted to ordinary matriculated students; thereby, we think with Miss Pechey, acting somewhat strangely and inconsistently.

From a correspondence which has been going on in one of the leading daily papers on substitutes for rags in making paper, it appears that the chance of wood being thus used successfully is now much greater than it has been, as the quantity of chemicals hitherto required to prepare it is said to be now so far reduced as not to exceed that required by other materials at present in use. Cotton-seed husk has also, it seems, been converted into paper at one of the Lancashire paper-mills. From this material being ready to hand in large quantities as a refuse from another manufacture, the idea of utilizing it in this way is a happy one, and merits the success it is likely to obtain.

A most decided and favourable opinion is expressed in the Report, just published, of the officers deputed by the British Admiralty to examine the Suez Canal, to the effect that any practical inconvenience to navigation from the filling up of the entrance to Port Said may be considered as remote, but if at any future time it should arise, the remedy is sure and simple—viz., the extension of a breakwater.

Mr. R. Mallet has been led by an article in the *Times* on the vulnerability of ships' decks to vertical or shell fire, to recall attention to the 36-inch mortars designed by him, and now lying at Woolwich, for throwing gigantic shells. Shells of 2,548 lb. in weight, and capable of containing a bursting charge of 480 lb. of powder, giving a total weight of not far short of a ton and a half, were thrown in 1857, with 70 lb. projecting charge, from one of these mortars, to ranges exceeding a mile and a half, and which penetrated upon falling eight yards and upwards into the soil; each thus boring a cavity as wide and deep as many a well. Up to the present moment these shells remain the largest, most ponderous, and most formidable projectiles ever launched by the hand of man.

The sudden death from apoplexy is recorded of M. Niépce de Saint-Victor, well known by his labours in photography.

It is announced that the Council of the International Decimal Association will hold a conference on international coinage, the introduction of metric weights and measures, and the abolition of troy weights, on Friday, May 6, at eight o'clock, in the rooms of the Society of Arts, Earl Fortescue in the chair.

Mr. George Augustus Ibbetson, F.R.C.S., late President of the Odontological Society, and lecturer on dental surgery at University College, has been elected an examiner in dental surgery, in the vacancy occasioned by the resignation of Mr. John Tomes, F.R.S., one of the earliest members of the Board. Mr. Ibbetson is deservedly well known by his valuable contributions to the advancement of odontological science.

In consequence of the experiments of M. Labordette, the National Lifeboat Institution has decided on omitting from its new instructions the statement that among the appearances which generally accompany death the "jaws are clenched and the fingers semi-contracted." Dr. Labordette's experiments on animals, have clearly proved that in nine out of twelve cases, after clenching of the jaws, &c., had been observed, life had been restored; and has given several instances of human beings having been resuscitated under similar circumstances. He has also in the strongest manner expressed his opinion, founded on these facts, that the clenching of the jaws and contraction of the fingers, after short immersion, indicated remaining vitality, and that the same should encourage perseverance in the efforts to restore life.

The third course of Cantor Lectures for the present session will be given by Professor A. W. Williamson, F.R.S., and will be on Fermentation. The first lecture will be given next Monday evening at eight o'clock.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

ON THE FORMATION OF DEW AND ITS EFFECTS.

BY HENRY HUDSON, M.D.

In Two Parts.—Part II.

In page 6 Dr. Wells says, "Dew probably *begins* to appear upon grass, in places shaded from the sun, during clear and calm weather, soon after the heat of the atmosphere has declined." Also, "I have frequently *felt grass moist*, in dry weather, *several hours* before sunset; on the other hand, I have *scarcely ever* known *dew* upon grass to exhibit *visible drops* before the sun was very near the horizon, or to be very copious till some time after sunset." Again (p. 27), "According to a few observations made by me, the greater coldness of grass than that of the air *begins* to appear, in clear and calm weather, in places sheltered from the sun, soon after the heat of the atmosphere has declined." From the comparison of these passages it will be obvious that the dew process was in active operation when the "coldness of grass compared with air" became apparent, and *long before* he could obtain any addition to the weight of his wool. In page 14 he writes, "I placed, on a clear and still night, 10 grains of wool upon the middle of a painted board (4½ ft. by 2 ft. and 1 in. thick) elevated 4 ft. above the grass-plot, and, at same time, attached loosely 10 grains of wool to the middle of its underside; *on one night* (the extreme case) I found the upper parcel had gained 20 grains in weight, but the lower one only 4 grains." Again (p. 15), "Ten grains of wool on the grass-plot, directly under the middle of the raised board, acquired during one night 12 grains of moisture, while the quantity gained during the same time by an equal parcel laid upon the grass-plot entirely exposed was 20 grains." It must be obvious that the wool *attached* to the under side of the raised board was probably at least *fifty times* less exposed to the supposed influence of "radiation" than the similar parcel beneath the centre of this board on the grass-plot. In page 18, "The freedom of certain situations from dew depends much more upon *extraneous circumstances* than upon the nature of the substances found there, for river sand (very similar to gravel) when placed upon the raised board, or on grass, attracted dew copiously," though the gravel walk continued dry. Why, then, ascribe the

phenomena to "radiation"? In page 19, he speaks of the "Inaptitude of Metals to Attract Dew," which recalls an observation of Leslie (*Relation of Air to Heat and Moisture*, pp. 75-6), viz., that the differential *hygrometer* placed under a *glass* receiver (in which water is undergoing evaporation) *never sinks to zero*; the air, notwithstanding the most copious evaporation, *never reaching a state of saturation*, inasmuch as the glass receiver is continually withdrawing moisture from it; whereas, with a *metal* receiver, the hygrometer does sink to the zero of the scale. In p. 33 Dr. Wells says:—"In still and serene nights, the surfaces of the gravel-walk and the bare garden-mould were always warmer than the neighbouring grass, and *frequently* warmer than the air. On one such night, two hours and a half after sunset, the gravel walk was 16½° and the garden mould 12½° warmer than grass very near them, and similarly exposed." This did not arise (as he himself admits, p. 34) from diversity of radiative energy. The deposited vapour imparted its own cold temperature *to the grass*, and this chill is not counteracted by *conduction* of heat from the earth—as in the case of the walk and mould. These latter being thus maintained at a higher temperature, little or no moisture could be deposited to chill them. In p. 34 he writes, "I have always found, *on dewy nights*, the temperature of the earth ½ in. or 1 in. beneath its surface warmer than the grass upon it from 12° to 16°." Almost exactly the temperatures he gave before as the excess of heat of garden walk and mould above that of the grass equally exposed as regards *radiation!* I extract the following from p. 51, viz.:—

TABULAR VIEW OF OBSERVATIONS ON EVENING OF AUG. 19, 1813.

	H. M. 6 45	H. M. 7 0	H. M. 7 20	H. M. 7 40	H. M. 8 45
Heat of Air 4 ft. above grass	60½°	...60½°	...59°	...58°	... 54°
„ Surface of raised board	58	...57	...55½	...—	... —
„ Wool on raised board.....	53½	...54½	...51½	...48½	... 44½
„ Swansdown on raised board	54½	...53	...51	...47½	... 42½
„ Grass-plot	53	...51	...49½	...49	... 42

I wish merely to observe that the wool on the raised board was, to some extent, sheltered by it from the influence of the warm air rising from the moistened grass. The temperature of the board itself (so far as he has given it) proves this, comparing temperature of board with that of air at same elevation. As regards the amount of heat imparted to the air, it may suffice to point out that the latent heat of the 20 grains of moisture (which he frequently found in ten grains of wool) would raise the temperature of 20 cubic feet of air about eight degrees; hence we see what a vast amount of heat must have been imparted by the vapour deposited on the grass plot, and wonder how such a *vira causa* has been ignored in the explanation of the phenomena, and yet Dr. Wells only notices the fact in the following terms (p. 53):—"The formation of dew, indeed, not only does not produce cold, but, like every other precipitation of water from the atmosphere, produces heat!" In page 54 he mentions the *greater difference* (at night when calm and clear) *in very cold weather* between temperatures of the air and of bodies on the earth. On this we may observe that *when hoar-frost* is formed, the heat communicated to the air will be the *sum* of the latent heats of vapour liquefied and of water solidified. Hence a larger "differential temperature." In page 72 Dr. Wells admits that "bodies exposed on a clear night must radiate as much heat to the sky during the prevalence of wind as they would do if the air were altogether still; but in the former *little or no cold* will be observed upon them above that of the atmosphere." That is to say, in fact, there was little dew, and therefore the atmosphere received *little or no heat* from this source.

In conclusion, I must state my conviction that Dr. Wells was led astray from having adopted Prevost's theory of radiation, which I have always rejected as inconsistent with the varying "radiative energies" of different surfaces. Thus—imagine a thermometer in the focus of a mirror, and a cubic canister (two *adjacent* sides being of bright metal and the other two varnished) to be placed *angularly* in the line of the axis of the mirror, it will be admitted that (on the supposition that the temperature of the mirror, thermometer, medium, and canister are identical), no effect will be produced on the thermometer in the focus whether the metallic or the varnished sides are "radiating" to the mirror, and yet the "radiative energy" of the varnished sides is *many times greater* than that of the metal; why then (on Prevost's theory) does not the thermometer indicate the increased reflection to the focus? It will be understood that the *angular* position of the canister is to meet any argument founded on "the metal reflecting the thermometer's radiation back again to it." Again (with a similar arrangement), let the canister *alone* be colder than before. Why does the *varnished side chill* the thermometer in the focus more than the metal does, although the former is so much more potent in radiating heat? Above thirty-four years ago I made an experiment which I considered to be an *experimentum crucis* on this subject. I had a metallic vessel made, one of its sides being a concave mirror. It was filled with water at 173°, and one ball of a delicate differential thermometer being placed in the focus of the mirror, the other ball was moved round until the instrument stood at the zero of the scale (a large tin screen was in part of the mirror at a distance of about 6 ft.). The temperature of the room being 55°, a cubic canister containing water at 67° was placed just in front of the tin screen. The focal ball showed an increase of its temperature, and the rise was greater with the varnished sides of the canister. On moving the canister, however, nearer to the mirror, the effect *diminished*, and at a certain distance the effect (from both sides) became *nil*. On being moved nearer still to the mirror the canister began to act as if it were a *cold body*, and the varnished surface produced the greater chilling effect.

I read a paper containing these results in Section A of the British Association, at their first Dublin meeting (in 1835), and was honoured by its having been printed *in extenso* amongst the *Reports*. I did not *then* call attention to the object of the experiments, farther than to say that I considered them only applicable on a "wave theory."

As Prevost's theory is still generally received, I no longer hesitate to assert my belief that it is not true, the facts I have adduced appearing to me to prove that when any body is *of the same temperature as the medium* there is *no* "radiation." But, when it is either of a *higher* or lower temperature than the medium, waves (either of *excess* or deficiency) are propagated from it through the medium; a result to which a rude analogy may be found in imagining a bucket of water poured into (or taken out of) one end of a long narrow water-channel. The previous equilibrium is thereby overthrown, and a wave is propagated either from or towards the site of the disturbance.—*Paper read before the British Association.*

I should much regret it if I appear not to have done justice to Dr. Wells in the remarks I have felt it necessary to make on his ingenious essay.

His love for truth and devotedness to the investigation of it, under failing health, are worthy of the highest praise. But our respect and admiration for the man must not afford protection to erroneous views in science.

Properties of Galvanically-Precipitated Iron.—According to E. Lenz, in the *Bulletin* of the Academy of St. Petersburg, iron and copper, when reduced to the metallic state by electricity, contain gases occluded, among which, hydrogen is the largest amount; the bulk of gas thus occluded varies considerably, but iron has been found by the author to occlude as much as 185 times its own bulk. The absorption of the gases is more considerable in the first layers of metal deposited. On being heated, the iron loses gas, even below 100°; the gas evolved at so low a temperature being chiefly hydrogen. Iron which has been galvanically precipitated, and then made red-hot and cooled, becomes oxidized when put into water; that liquid being decomposed and hydrogen given off.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From April 10th to 16th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
2 Derbian Wallabys (Halmaturus derbianus) ♂ & ♀	Australia	Presented by H. W. Peek, Esq., M.P., F.Z.S.	Kangaroo-sheds
1 Sociable Vulture (Vultur auricularis)	West Africa	Presented by J. J. Monteiro, Esq., C.M.Z.S.	Vultures' Aviary
1 Egyptian Sand Lizard	Laghouat, Algeria	Presented by F. Bond, Esq., F.Z.S.	Reptile-house
1 Red-legged Partridge (Caccabis rufa)	Europe	Purchased	Western Aviary
1 Marmoset Monkey (Hapale jacchus) ♂	Bahia	Presented by Lady Louisa Dillon	Monkey-house
1 Philippine Deer (Cervus marianus) ♀ *	Philippines	Purchased	Deer-sheds
1 Sooty Crow Shrike (Strepera fuliginosa)	Australia	Ditto	Parrot-house
2 New Zealand Gulls (Larus sp.)	Antarctic Ocean	Ditto	Gull-pond
2 Bronze-winged Pigeons (Phaps chalcoptera)	Australia	Ditto	Western Aviary
5 Maugè's Doves (Geopelia Maugæi)	Timor	Ditto	Ditto
1 Great American Egret (Egretta leuce)	Para	Ditto	Ditto
2 Common Cassowaries (Casuarius galeatus)	Ceram	Presented by Admiral Sir H. Keppel, K.C.B.	Upper Yard
1 Bengalese Leopard Cat (Felis Bengalensis)	India	Ditto	Small Mammal House
1 Himalayan Bear (Ursus Tibetanus)	Asia	Ditto	Carnivora-dens
3 Tibetan Wolves (Canis laniger)		Born in the Menagerie	Ditto
1 Talapoin Monkey (Cercopithecus Talapoin) ♂	West Africa	Purchased	Monkey-house
1 Ursine Colobus (Colobus ursinus)	Ditto	Ditto	Ditto
1 Red and Blue Maccaw (Ara macao)	Central America	Presented by Mrs. Coffin	Parrot-house
1 Entellus Monkey (Semnopithecus entellus)	India	On approval	Monkey-house
3 Cretan Goats (Capra beden)		Born in the Menagerie	Goat-sheds
1 Mouflon (Ovis musimon)		Ditto	Sheep-sheds
8 Common Hares (Lepus Europæus)	British Islands	Purchased	Upper Yard
1 Axis Deer (Cervus axis)		Born in the Menagerie	Deer-sheds
2 Many-coloured Parrakeets (Psephotus multicolor)	Australia	On approval	Parrot-house

♂ Male. ♀ Female. * Never previously exhibited.

A NOTICE OF RECENT OBSERVATIONS ON AMŒBÆ AND MONADS BY RICHARD GREEF AND L. CIENKOWSKI.

BY HENRY E. FRIPP, M.D.[1]

IN THREE PARTS.—PART I.

THE discovery of certain species of Amœbæ and Rhizopods living in the earth is one of great interest and startling novelty; for all previously observed species have been found only in water, either fresh or salt, and all that we have hitherto learnt of the mode of life of these creatures seemed to indicate the impossibility of their being able to enjoy an active existence in any other medium. Least of all, should we have conceived it likely that they could find in the driest earth or sand all the conditions necessary to their wellbeing. A fresh and fruitful field of microscopic research is opened to our observation by Dr. Greef's interesting discovery, and in introducing it to the notice of our Natural History Society, I take the opportunity of recommending further researches in this direction to such of our members as are desirous of turning the field operations of our summer campaign to good account. Our excursions will yield ample occasion, during the period of the year best suited to the purpose. The history of the Protozoa, though greatly advanced in late years, has many voids and wide gaps, and doubtless some of the missing links in our record may be supplied by careful microscopic examination of "mother earth," teeming with minute life. Besides the future prospect, however, a present and special value attaches to this inquiry, as it bears closely on a question much discussed, but still far from settlement, namely, this—Does structural adaptation precede specialized function, or *vice versa?* or are both coincident? The facts I have to relate support the doctrine not yet held in favour by many, that the earliest specializations of the primal endowments of living organic matter coincide exactly with structural differentiation. The classification of the different groups of Protozoa, including all the lowest types of animal life is, in our present ignorance of the exact cycle of changes occurring in each individual, and of the limits of the several types with which we are as yet acquainted, necessarily incomplete. Huxley's first group (Monerozoa, including Amœbæ and Rhizopoda) contains animals in which a noticeable advance in organization may be recognized, when we compare the simplest member of the group "Protrogenes," with the typical *Amœba princeps*, in which a generative organ (nucleus) and a vesicle or vacuole are always found present in the diffluent plasm of which its body is composed. It is, I think, questionable whether the original notion of a distinct species or genus can be retained under the term Amœba. The occurrence of well-recognized Amœboid stages in the life-history of the other groups of Protozoa, and the remarkable alternation of what at one time appears to be vegetable, at another time animal, protoplasm in the body of the same Monad, during successive periods of its life, seem to indicate that the Amœboid state of organic matter is a very general phenomenon. If it really be the life-long condition of one animal, it is certainly but the occasional and transitory condition of another. On the other hand, this Amœboid state of organic matter is as certainly associated with a definite constitution of the organic compound, and with an equally specific manifestation of vital properties. Contractility is perhaps the most fundamental endowment of the simplest and entirely structureless particle of living propoplasm. But the contractility of an Amœba has a method of its own—that is to say, it has become specialized so as to exhibit a motility exercised in a particular manner, and apparently responds only to special stimuli. The motility of an Amœba destitute of "organs of motion," could hardly be denied a material cause, and this again can only be sought for in a specific molecular constitution of its contractile substance—*i. e.* molecular constitution is here the only "structural adaptation" which stands in place of organ, or instrument of the newly-acquired motility. Our finite senses cannot discern any visible apparatus, but we must acknowledge the existence of an agent where we see an act performed. And whatever be our explanation of vital force, we must admit that its physical basis is a material "sui generis." Apart from the animal's power of self-preservation, growth, and propagation, the chief characteristic of the Amœboid

[1] We do not usually reproduce at length the papers read before provincial societies; but the following communication is so exceptionally good that we should be neglecting our readers' interests did we pass it over.

state of animal matter is its peculiar motility, derived, so to speak, from the primal endowment of contractility, and the loss of this character is always coincident with some change of organic constitution of the living plasm. Another kind of motility we find associated with corresponding structural adaptation in the Zoospore (animal or vegetable). Cienkowski's observations prove that certain Monads take in food and pass through phases of development which entitle them to be considered animals.

In their motile stages, the Monad body consists of a naked plasm, containing vacuole and nucleus. In the absence of all definite form, this body is the equivalent of an Amœba; but with the addition of a tail, which is often developed, it is a Zoospore, an organism equally mobile with the Amœba, but differing in the manner in which its mobility is exercised. In after periods of the Monad's life a motionless encysted condition obtains, during which assimilation of food previously taken in goes on, until a new generation of Zoospores begins in a sac contained within the capsule of the encysted parent. This encysted stage of the Monad yields in one species Amœboid forms like Actinophrys, in another a cluster of Zoospores,—the latter form of reproduction being in all respects the exact parallel of the encysted state of Algæ, &c.

Again, certain infusoria exhibit an encysted state of two kinds—one corresponding with the motionless reproduction cyst of Algæ, the other with the monad cyst full of Zoospores.

The motility of the pseudopodia of Rhizopods is obviously of the same kind as that of the Amœboid substance. The pseudopodia look indeed more like "organs" of motion, but their temporary form and function implies no further structural adaptation than that of the Amœboid mass.

Facts such as these prove, in my opinion that there is throughout the lower forms of animals an approach towards specialization of functions, associated in each case with a correlative change of molecular constitution. If Amœboid forms of matter be destitute of structure, in the sense of distinct apparatus developed and set apart for the constant exercise of a particular function, such imperfect specialization of function and incomplete differentiation of the organic matter by no means warrants the assumption that this matter is intrinsically indifferent, and without any trace of organization.

With respect to the place of the typical Amœba in our classifications, it follows, I think, from the views here expressed, that this animal must find its position in the scale according to its whole life-history. The possession of a body composed of contractile plasm is, as we know a common character of all Protozoa at some period of life,—probably also a common character of all living creatures in their elementary state. The Amœboid state of a white blood-corpuscle, even in man himself, is to all appearance the same as that of the body of Protogenes, and this fact is well expressed by Huxley in his recently published *Lecture on the Physical Basis of Life*. To determine the proper limits of the Amœba as a species, the complete revelation of its life-history and the observation of fresh species is required, and Dr. Greef's researches have therefore great value. While considering the subject-matter of Dr. Greef's paper, it may be well to keep in mind the present state of opinion in England respecting the absence of all organization in that class of Protozoa which includes the Rhizopods and Amœbæ. For this purpose I give here an extract from Huxley's Lectures published in 1864. In his *Elements of Comparative Anatomy*, the author thus introduces the Rhizopod:—

"It seems difficult to imagine a state of organization lower than that of Gregarinida, and yet many of the Rhizopods are still simpler. Nor is there any group of the animal kingdom which more admirably illustrates a very well-founded doctrine, and one which was often advocated by Hunter himself, that life is the cause and not the consequence of organization. For in these lowest forms of animal life there is absolutely nothing worthy the name of organization to be discovered by the microscopist, though assisted by the beautiful instruments now constructed. In the substance of these creatures nothing is to be discovered but a mass of jelly, which might be represented by a little particle of thin glue—not that it corresponds with the latter in composition, but it has that texture (?) and sort of aspect. It is structureless and organless, and without definitely formed parts; nevertheless it possesses all the essential properties and characters of vitality. It is produced from a body like itself; it is capable of assimilating nourishment and of exerting movements. Nay, more, it can produce a shell,—a structure, in many cases, of extraordinary complexity and singular beauty."

"That this particle of jelly is capable of combining physical forces in such a manner as to give rise to these exquisite and almost mathematically arranged structures—being itself structureless, and without permanent distinction or separation of parts—is, to my mind, a fact of the profoundest significance."
—(Pp. 10, 11.)

In a later chapter (p. 83) Huxley returns to the discussion of the limits and subdivisions of the class Rhizopoda, and briefly states the following as the conclusions to which a careful study of the extant literature of the subject, as well as his own investigations, lead.

It appears that three or perhaps four, types of structure obtain among the Rhizopoda.

1st. That of the Amœbæ, Rhizopods with usually short pseudopodia, a nucleus, and a contractile vesicle.

2nd. That of the Foraminifera-Rhizopods, devoid of nuclei and of contractile vesicle, and for the most part with long pseudopodia, which commonly run into one another and become reticulated.

3rd. That of Thalassicollæ, provided with structureless cysts, containing cell elements and sarcode, and surrounded by a layer of sarcode, giving off pseudopodia, which commonly stand out like rays, but may, and do, run into one another, and so form networks.

The fourth type of structure is probably furnished by those anomalous creatures, the Acinetæ; the radiating processes of which serve as suctoria tubes, down which the juices of their prey are conveyed.—*Proceedings of Bristol Naturalists' Society*, vol. iv. part 2.

HODGSON'S WIRE TRAMWAYS.

IN the spring of 1869 Mr. Charles Hodgson, C.E., patented and published his method of Wire Tramways, and readers of this journal will remember that the invention was fully illustrated and described at the time in our pages.[1] The single trial line then constructed at Leicester so satisfactorily exemplified the inventor's method, that in the short space of twelve months more than a dozen lines have been constructed, and fourteen are in course of erection in various parts of the world, the system having found especial favour in France, where seven lines are made use of in the carriage of beet-root, and so successfully, that the lessees of the patent are desirous of not only possessing the sole right to work the system in France, but also of buying up the inventor's royalty.

At the request of some gentlemen with whom he was in negotiation for the supply of materials for a line of 60 miles in Ceylon, Mr. Hodgson has erected five miles of the proposed plant on Brighton Downs, to show, on an extensive scale, the advantages and capabilities of his system as applied to the carriage of produce and materials of all kinds over difficult country; and on Wednesday last a numerous party of gentlemen, at the invitation of the Wire Tramway Company, personally witnessed the working of this line, attended by Mr. Hodgson, Mr. Bevington (the engineer in charge), and Mr. Montague Beale, the company's agent.

[1] *Vide* SCIENTIFIC OPINION, vol. i., pp. 336 and 353.

The wire-rope transport system may be described as consisting of an endless wire rope running over a series of pulleys carried by substantial posts, which are ordinarily about 200 ft. apart. This rope passes at one end of the line round a drum driven by either steam, water, or even horse power, in small farming operations, at a speed from four to eight miles per hour. The boxes in which the load is carried are hung on the rope at the loading end by a wooden Λ-shaped saddle, about 14 in. long, lined with leather, and having four small wheels, with a curved pendant, which maintains the box in perfect equilibrium while travelling, and most ingeniously, but simply, enables it to pass the supporting posts and pulleys. By a sliding-ring arrangement the boxes or buckets are easily emptied by tilting, without unshipping the saddle from the rope. The boxes can be made to carry from 1 cwt. to 10 cwt., and the proportions of the line and the loading and discharging arrangements can be varied to suit any particular requirement, ranging from 10 tons to 1,000 tons per diem. At each end of the line are rails placed to catch the small wheels attached to the saddles of the boxes, by which means the weight, having acquired momentum, is lifted from the rope, and, thus suspended from a fixed rail or platform, can be run to any point for loading or emptying, and again run on to the rope for transport, the succession being continuous and the rope never requiring to be stopped for loading and unloading.

Curves of sharp radius are easily passed, as well as steep inclines, and its applicability to cross rivers, streams, and mountainous or hilly districts will be apparent at a glance, as the cost of construction increases but little under such circumstances, whilst that of a road or railroad is, perhaps, increased tenfold, and the daily working cost doubled or trebled. The rope being continuous, no power is lost on undulating ground, as the descending loads help those ascending.

In the case of lines for heavy traffic, where a series of loads, necessarily not less than 5 cwt. to 10 cwt. each, must be carried, a pair of stationary supporting ropes, with an endless running rope for the motive power, will be employed, but the method of supporting, and the peculiar advantage of crossing almost any nature of country with a goods line without much more engineering work or space than is necessary for fixing an electric telegraph, without bridges, without embankments, and without masonry, exists equally in both branches of the system.

In the minor applications, such as short transport from mines to railways, the landing or shipping of goods in harbours and roadsteads, and the carriage of agricultural produce on farms, some peculiar features of the system render it specially advantageous. Amongst these are the facility with which power can be transmitted by the rope and taken off at any required point for mining or other purposes. In lines terminating on the seaboard, or on great rivers, a manifest advantage is secured in the facility for taking goods direct to or from ships in harbour or roadstead without transhipment into lighters.

Seen from a distance, the posts which carry the tramway wires at Brighton might be mistaken for telegraph poles, but a nearer inspection reveals a second line of wires on the same level, and upon these two wire-rope lines, supported on standards at intervals varying from 300 ft. to 1,000 ft. apart—according to the requirements of the ground,—are suspended iron boxes for the carriage of the goods, which boxes pass on noiselessly and steadily, carried forward by the rope at the uniform rate of five miles an hour—the time required for performing the entire circuit of the line.

In laying out these five miles at Brighton the opportunity has been taken of exemplifying the working of the system under every variety of difficulty that could possibly present itself; thus we have at one part an incline of 1 in 6, up and down, which the rope and boxes work with perfect facility, the descending weights assisting those which are ascending; then there are, besides several bends less acute, two instances of absolutely right-angles which are passed with the greatest ease; in some instances the standards are carried to the height of 70 ft. to meet inequalities of the ground, undulating and hilly country being more trying to this system than craggy and mountainous,—such as that for which this plant is designed, and where, from the long reaches taken, fewer posts will be required.

The line is rather over five miles long; there are 112 posts, or standards, in the whole length; these standards can either be made of light angle and band iron neatly put together, as in the present case, or of wood. The rope is made of charcoal iron, is 2 in. in circumference, each strand as well as the centre of the rope having a hempen core, to secure ductility. The power employed to drive the rope is a portable 16-horse power engine, by Robey & Co., who with Messrs. Eastons, Amos, & Anderson have supplied all the plant, with the exception of the buckets, which we are sorry to learn can be made more cheaply in France than in this country.

Some of the spans are 600 ft. and 900 ft. in length, and ingenuity has been shown in devising every possible mode of testing the merits of this system of transport; and we are bound to record that all difficulties have been overcome with complete success. The line is capable of delivering 240 tons per day of ten hours, *i.e.*, 120 tons in each direction.

It is intended to divide the proposed Ceylon line of 60 miles into 5-mile sections such as this,—one engine working every two sections, and the boxes passing each section by shunting arrangements, similar to those used at the termini, from one section to another. The line in work will be open daily to public inspection during the month of April, and is well worth a visit. It is hardly likely that so efficient and economical a means of transport will be for long exclusively confined, as at present, to the conveyance of goods. For ourselves, we venture to confidently predict an early adaptation of the principle of this ingenious system to passenger traffic. Meanwhile we commend our suggestion to Mr. Hodgson and the Wire Tramway Company.

HOW ESSENTIAL OILS ARE EXTRACTED.

OILS or greasy substances are impregnated with the odoriferous elements of the flowers by three different operations. Two of these depend upon the fact that oils or fats brought into contact with the flowers, absorb and retain their fragrance. If afterwards these perfumed fats and oils are thrown into pure alcohol, the latter extracts the perfume from the oils or fats, and thus an essence is obtained.

These two methods of working are called in France "enfleurage" and "maceration." For the process of "enfleurage" a sort of a frame with shelves is used. Between the wooden shelves are glass tablets, upon which the purified fat is spread. Upon these are laid the fresh-picked flowers. Some forty to fifty of these shelves are piled up and left for twenty-four hours, after which time the old flowers are removed and fresh ones put in their places. This process is continued until the fat is sufficiently impregnated with the odoriferous principle of the flowers; then the fat is melted from the glass at a moderate heat, and separated from the leaves which may have adhered to it, after which it is packed in jars and boxes, and is then ready for exportation.

"Maceration" is performed by soaking the flowers for a certain length of time in the fat or oil. Practice has shown that not all flowers will yield their perfumes in this way, some discharging their perfume with more facility than others. The acacia is particularly adapted for "maceration."

Of late years another process has been introduced, consisting in treating the flowers with various ethers, &c., but it is not yet in general use. Lastly, the odour of some flowers is obtained by distillation; but delicate odours are injured or dispersed by this operation.

The essence of orange blossoms obtained by "enfleurage" is

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far superior to that gained by distillation. Lavender is almost the only plant which does not lose by distillation.

Extracts obtained through "enfleurage" or "maceration" are the condensed odours of the living flowers, while by distillation we obtain only a second-class perfume.

It has been a question of considerable importance how to obtain the extracts of flowers of tropical countries. Experiments have been made in Algiers, but without favourable results. However pure the fat or oil used may be, it soon turns rancid in a hot climate. If the process of etherizing is brought to perfection, the flower culture of the south of France will doubtless diminish, for the tropics of America alone would furnish enough perfume to supply the entire western hemisphere. —*Scientific American.*

A GEOLOGICAL DREAM ON SKIDDAW.

BY J. CLIFTON WARD, F.G.S.

IN THREE PARTS. — PART II.

IT was a long winter, the winter of an age, but soon I saw that age's summer come. Changes slowly took place in the form of the land, which seemed extended in some quarters and retracted in others;[1] while, as the cold relaxed, life returned in great abundance, and soon the seas were overflowing with it. Vast numbers of corals, shells, and sea-lilies flourished, their skeletons[2] forming thick beds of shelly mud.[3] Fish, less uncouth in form than those which first I saw, abounded; while of the three-lobed crustaceans scarce a trace remained.

Now, methought I saw in my dream that this state of things lasted a prodigiously long time, during which I witnessed several volcanic outbursts take place in the seas of Derbyshire and the North of England. At last I caught a glimpse of the hazy outline of some far-off land to the north-east, and the waters of the sea seemed also gradually to become charged with sediment, transported, as I believed, from that land. In many parts vast sand and shingle beds were formed,[4] and a general shallowing resulted, partly, as it seemed to me, from filling up, and partly from a rising in the ocean's bed. Every here and there, there would now be seen some widely-spread tracts of low-land scarce rising above the level of the sea, and upon them a luxuriant vegetation soon arose.[5] Its character was peculiar, being formed almost wholly of the lowest orders of plants, yet of a gigantic size; huge horse-tails and tree-like club-mosses, with an abundant undergrowth of ferns. The positions of these luxuriant swamps frequently changed, a slight sinking causing the sea to sweep over them and cover up the decayed vegetable matter with sand and mud, while other parts of the sea would be silted up, or a slight elevation favour the growth of a new forest. Thus in some parts[6] I saw the land[7] alternately appear and disappear as many as fifty times, each land surface remaining exposed long enough for the growth and decay of countless generations of plants.

While all this was going on, a chain of islands in the centre of England, which had existed throughout all the earlier part of this period, gradually sank, and, at the same time, the northern shore-line of the south-eastern mass of land[8] receded a little southwards. For incalculable ages this state of things lasted, and my eyes being now more accustomed to the scene, I saw insects fliting about among the trees, and footprints, few and far between, of some strange reptile form.

At last an end to this approached. No sudden change, no overwhelming cataclysm took place; but slowly and gradually that giant power from beneath seemed to be upheaving the solid ground, and where swamps and shallow seas before existed high land stealthily arose. So gradually did this take place, that during the great uplifting vast thicknesses of the soft vegetable and earthy deposits were swept completely away by the ceaseless action of ocean's waves and by constant atmospheric wear. Especially did this happen along an east and west line crossing the northern part of our present England.[9] The land, as it at last appeared, seemed to be chiefly along the west.[10] Water, however, separated high ground in Cumberland from that farther south, while it seemed as if a narrow east and west land-barrier parted the northern from the southern seas.

Around these lands beds of sand or shingle were formed; and farther out to sea, in the northern gulf, shells and other marine organisms lent their aid to form calcareous mud. Huge frog-like reptiles I saw crawling on the sands, while the plants of the last long period seemed to be giving way before a hardier and a different class.

Again a change in climate crept on, and the warm and temperate was slowly changed for the cold and arctic. Glaciers flowed down the valleys, protruded into the sea, and broke off in huge bergs, which went floating eastwards scattering their stony freights over the ocean's bed.

This state of things was closed by a long period of unsettled movements, during which large tracts seemed to be from time to time upheaved from beneath the sea, merely to bring them within the power of the destroying elements. Notably did this denudation take place along a line running north and south in the northern part of England.[11]

Now, I saw in my dream that finally, after the lapse of a great interval of time,[12] during the latter part of which portions of the ocean were shut off and converted into salt lakes, there seemed to be established three distinct areas of land,[13] one occupying the north of England, another the west, and a third the southern edge of our present isle. At this time also, I again saw signs of volcanic activity over the present area of Devonshire.[14]

For a vast period of time this *general* configuration seemed to prevail, though gradually the whole of England's western half became land,[15] and life seemed to make great but gradual progress. Corals swarmed in the clear waters; shells in profusion abounded, but specially remarkable were those with a snake-like coil,[16] together with gigantic cuttle-fish;[17] sea-urchins,[18] of most various form; crabs and lobsters; and fish with equal-lobed tails. No longer, however, are fish, shark-like though many of them be, the monarchs of the ocean, for most strange sea-going reptiles pursue and feed upon them. Gigantic fish-lizards,[19] with huge goggle eyes, swim proudly about, steering themselves with their powerful tails; while close to shore, other monster forms, with long swan-like necks, but formidable jaws,[20] carry on the work of terror among all smaller fry; and crocodiles innumerable creep warily about. On the land, too, are equally huge reptiles, some feeding on flesh and some on herbs;[21] while the air itself is full of strange flying dragons.[22] Marsupial mammals also feed beneath the shade of araucarias and cycadeous plants, the whole presenting so close a likeness (with the exception of the large reptile forms) to the fauna and flora of Australia at the

[1] Carboniferous period.

[2] Not skeletons in the true sense of the term; fragments of those belonging to the sea-lilies are commonly known as screw-stones.

[3] Carboniferous limestone, seeming almost to be entirely composed of the separated joints of crinoids.

[4] Millstone grit-beds.

[5] Vegetation of the coal-measures.

[6] South Wales coal-field.

[7] By "land" is here meant low-lying or swampy ground.

[8] This land was possibly permanent throughout the period, and must be carefully distinguished from the sea-level land, on which alone coal-beds were produced.

[9] Formation of Pendle anticlinals.

[10] Permian period.

[11] Formation of Pennine anticlinal.

[12] The long period that elapsed between the end of the Primary and the commencement of the Secondary epoch.

[13] Triassic and Liassic periods.

[14] In Triassic times.

[15] Oolitic period.

[16] Ammonites.

[17] Belemnites.

[18] Echini.

[19] Ichthyosauri.

[20] Plesiosauri.

[21] Deinosauria.

[22] Pterodactyli.

present day, as to suggest the thought that the latter may possibly be a relic of these ancient times.

In the northern part (Yorkshire) of the narrow seas of this period, I saw, at times, large delta deposits formed, which, being converted into low-lying flat tracts of land, supported a luxuriant growth of tree-ferns, cycads, and palms. From time to time these areas were again sunk beneath the waters, and the deposits of vegetable matter[23] were covered up and preserved, as I had witnessed in a former and vastly more remote epoch. Among the trees flitted many bright and gaudy insects; while strange semi-reptilian birds[24] winged their flight around and aloft. All seemed to indicate a warm if not a tropical climate.

But, after a long lapse of time, I remarked a general, though gradual, extension of the land eastwards by a slow elevation taking place over nearly the whole of England's area, with the exception of the extreme south-eastern part, where the previously existing land subsided.[25] About this part the waters of a mighty river entered the sea, draining the now extensive land to the west and north-west, which was still the abode of monster reptiles, while crocodiles in great number frequented the river, or lazily basked in lagoons among scattered islands.

For ages flowed that river down, bearing materials derived from the waste of the land, and forming a large delta at its mouth; till, at length, a gradual sinking caused an encroachment of the sea which spread slowly westward and northward, and England was represented by land only along its present western half. In this sea[26] were especially to be noted strange and irregular forms of chambered whorled shells,[27] while other kinds of marine life abounded as usual. In the deeper parts of the sea innumerable minute creatnres, with elaborate shells,[28] lived and died, their remains forming a great thickness of white mud in the ocean's bed, of which ocean the present Atlantic seems almost to be a remnant. Now and then, too, an iceberg came floating from the far north, letting its stony freight fall on to the bed of the sea as it gradually melted away.—*Pamphlet, published by Trübner & Co.*

THE OSMOGENE.

THE inventor of the Osmogene process, for purifying molasses, M. Dubrunfaut, has lately reviewed in the columns of the *Journal des Fabricants*, the progress which his invention has made, and the extent to which it is adopted in the French sugar manufacture. We are not aware that the process has been introduced into this country in a single instance, indeed, it is chiefly valuable for operating on beet-sugar molasses, on account of the soluble salts, which are the chief impurities of this syrup, and which the Osmogene process is so efficient in removing.

M. Dubrunfaut first made public his adaptation of the principle of dialysis in a work presented to the Academy of Sciences in November, 1855, in which he announced that he had succeeded in applying the power of Osmose to the separation of certain mixtures.

Dutrochet appears to have been the first to study the peculiar behaviour (called Osmose) of saline solutions when separated from water, &c., by a diaphragm of a membranous nature. He was followed with greater accuracy of results by Vierordt, Professor Jolly, and by the closer researches of Graham. The term Osmose, derived from a Greek word signifying impulsion, comprises the two terms endosmose (diffusion through inwards) and exosmose (diffusion through outwards). The first experiment in connection with it was performed by suspending a closed bladder holding a saline solution in a vessel nearly full of water. The salts passed through the bladder into the water at a certain speed, and the water entered into the bladder at a certain speed, but the velocity of diffusion was not alike in each. The more rapid flow from the thinner to the thicker fluid was called endosmose, and the opposite slower current exosmose. It is this principle of dialysis, or diffusion, which M. Dubrunfaut successfully adapted to the purification of beet molasses and the extraction of sugar contained therein. These molasses are a mixture of sugar and different salts, chiefly nitrate of potash and chloride of potassium, which retard and in certain cases prevent the crystallization of the sugars which are present with them. If, then, the proportion of salts in the molasses can be diminished by whatever cause, the molasses will furnish a further quantity of crystallizable sugar.

This result M. Dubrunfaut obtained by placing in the endosmometer of Dutrochet molasses of the usual density in the presence of water, and then causing two currents to flow; a strong one forces the water against the molasses, the other, more feeble, forces the molasses against the water, a diaphragm separating the two. The effect is such that the molasses parts with the greater part of its salts to the water, but with little or none of its sugar, so that the molasses remaining contains much less salts and nearly the same proportion of saccharine, which, by the usual operations of the refinery, may be separated in the form of crystallizable sugar.

Such is the principle of this mode of treatment of molasses and other saccharine liquids, and to the apparatus for carrying it out M. Dubrunfaut has given the name of an "Osmogene."

In an osmogene there are two distinct reservoirs separated by a permeable partition. One of these receptacles contains the molasses or syrup, the other is filled with water; the medium separating the two liquids is of parchment paper.

Each receptacle consists of a casing, the top, bottom, and ends of which are of rather thick wood, whilst the sides are furnished with parchment paper; each casing is about 3 ft. in length, 2 ft. in breadth, and $\frac{3}{4}$ of an inch in thickness. Four bars of wood divide the interior of the casing lengthwise into five compartments, which communicate with each other by an opening in each bar. On each side of the casing is fixed a leaf of parchment paper, kept in place by slender strings. Thus, when the molasses is allowed to enter at the lower part of the casing, it rises in a serpentine manner through the five compartments to the top of the casing whence it may flow out.

A second casing, exactly similar for the water, is joined to the first in such manner that one leaf of parchment paper serves to separate the two cases. This pair constitutes what may be called a set or couple of osmogenes, but as one couple would allow of the treatment of only a small quantity of molasses, a number of these double casings are united, say 25 for water and 25 for molasses, which work simultaneously. The result is, of course, according to the number of cases employed, and it is the union of these cases which is called an osmogene. It is only requisite for success that all the cases of molasses and all the cases of water should fill and empty themselves simultaneously, as if only a single couple were being operated with; to effect this, the molasses enters at the bottom of one end of the series of cases, and a tube communicates with each, the water entering by the top filling simultaneously every water casing and flowing out at the bottom.

There is thus maintained a constant efflux of molasses and of water in the osmogene, the two liquids being all the time kept separate during their course by the membrane of parchment paper.

For the following example we are indebted to M. V. De Luynes, in *Le Monde*. The process was applied to the purification of some Prussian molasses, which contained, according to analysis, 50 per cent. of crystallizable sugar and 14 per cent. of salts. Six successive operations of the osmose process were performed, each of which reduced the density of the molasses from 40° to 30° Baumé, and thus necessitated a fresh concentration after each operation to bring back the density to 40°, so that the process might be carried out in identical conditions throughout, so as to render the effects comparable.

[23] Coal-beds of the Yorkshire Oolites.
[24] Archæopteryx.
[25] Wealden period.
[26] Cretaceous period.
[27] Anomalous form of the Ammonite family.
[28] Foraminifera forming the great bulk of the chalk.

The following results were obtained by the analysis of the six waters, by each of which the 100 grammes of molasses had been treated :—

	Sugar.	Salts.
1st Water	0·5	4·0
2nd ,, ...	0·5	2·0
3rd ,, ...	0·5	1·0
4th ,, ...	0·5	0·5
5th ,, ...	0·5	0·3
6th ,, ...	0·5	0·3

These figures, with a slight correction, clearly indicate the law according to which the reaction is accomplished under the specific conditions; we see, in fact, that in proportion as the osmosed syrup is rich in sugar, the diffusibility of the sugar, which is slight, does not sensibly change; but this is conditional on constantly maintaining the density of the syrup. On the other side, we see that, in consequence of the same property, the amount of salts diffused in the six successive operations decreases in geometrical proportion accordingly as the liquid treated is deprived of its very diffusive salts; and in the conditions of this experiment, for example, the diffusibility ceases to decrease at a certain limit, *i.e.*, when the quantity of the salts remaining in the syrup is reduced to six-fourteenths of the whole. The experiment also shows that although the molasses lost only 1 per cent. of its sugar during the first two operations, 6 per cent. of salts were removed.—*The Sugar Cane.*

SETTLE CAVE EXPLORATION.

BY W. BOYD DAWKINS, F R.S.

THE cliffs of mountain limestone in the neighbourhood of Settle are penetrated by numerous caves, some of which are empty, some traversed by water which is silting up their lower chambers, while others have been filled in some places up to the very roof with débris of various kinds. All these caves have been at some time or other subterranean watercourses, and have been formed partly by the friction of the substances brought down by the stream, but principally by the chemical action of the carbonic acid in the rainwater by which the insoluble carbonate of lime of the rock is converted into the soluble bicarbonate. Some have been inhabited at various times by man and wild beasts, and therefore may be expected to furnish valuable evidence of a condition of things that has now passed away. The last recorded case of their being used by man as a place of refuge was in the rebellion of 1745, when the eldest son of one of the gentlemen in the neighbourhood was hidden in a large cave, in the fear that the Scotch would pass southwards in that direction instead of by the Preston route.

The first cave chosen by the committee for exploration is that found by Mr. Jackson on the coronation-day of our Queen, and which is therefore known as the Victoria Cave. It consists of a series of large chambers and passages, which are nearly filled to the roof with reddish grey clay and stones. It must at one time have been of wonderful beauty, for there are the remains of massive stalactites and of thick pavements of stalagmites; but now they are so decomposed by the carbonic acid that they are reduced to the condition of very soft mortar. Curiosity-hunters have also been doing their usual ruthless mischief. Mr. Jackson obtained, when it was first opened, a remarkably large series of ornaments and implements of bronze, iron, and bone, along with pottery and the remains of animals, from the chamber at the original entrance. They were all derived from a superficial deposit, and could not be assigned to any earlier date than that of the Roman occupation. The pottery was of the same kind as that so commonly found in the refuse-heaps round Roman villas, and some of it was Samian. There were also Roman coins. The broken and in some cases burnt bones belonged to the Celtic shorthorn (*Bos longifrons*), the sheep or goat, the horse, dog, red deer, and roebuck. The two former animals were by far the most abundant. The exploration committee resolved to follow up this discovery by a thorough examination of the cave, which they are able to undertake by the courteous permission of the owner, Mr. Stackhouse.

Outside the entrance of the cave and at lower level is a small plateau, composed of débris, which lies at the exact point where daylight could be seen through chinks from the inside of one of the large chambers. As both the plateau and the chamber were undisturbed, the committee determined to begin work by removing the débris and making a new entrance into the cave. While this was being done the following section was exposed:—On the surface there was a stratum of fragments of limestone that had fallen from the cliff above, in thickness about 2 ft. This rests on a layer of dark earth 18 in. thick, that furnished large quantities of bones, nearly all of which had been used for food, and several articles of bronze, iron, and bone of the same kind and age as those described above. The pottery is also of the same Roman character. Fragments of charcoal also were abundant, and some stones bore the marks of fire. There can be no doubt that this was the place where the dwellers in the cave during Roman or immediately post-Roman times in Britain kindled their fires and cooked their food. Underneath is an accumulation of limestone fragments that had dropped from the action of the atmosphere on the cliff above, from 6 to 7 ft. in thickness. In some places they were coated with decomposed stalagmite. It rested on a layer of grey clay. On the junction-line between them, and close to the entrance that is now being made into the chamber, two rude flint flakes, a remarkably large jawbone of bear, the broken bones of the Celtic shorthorn (*Bos longifrons*), and of the red deer were found.

On 4th April a most remarkable bone harpoon was dug out from the same horizon. It is between 4 in. and 5 in. in length, and is furnished with two barbs, arranged on each side opposite each other, that compose the head of the implement. The base presents a form making its attachment to the handle secure which, so far as my knowledge goes, is new to Britain. Instead of having a mere projection to catch the ligatures, there is a well-cut barb on either side, that points in a contrary direction to those on the head. Were the bases of a barbed arrow-head and of a harpoon joined together, the resultant would be a form analogous to this in question. There can be no doubt that man occupied the spot before the accumulation of the overlying stones. Ample use for his harpoon he would find in the mere, now drained and turned into green fields, which lie but a short distance away. So far as the work has proceeded there is no trace of metal at this horizon in the section.

The value of the evidence hitherto obtained lies in the fact that the Roman stratum is separated from the lower bed from which the flints, harpoon, and bear were found by the talus of angular stones. And this in a rough way will enable a computation to be made of the lapse of time between them. If we allow that for a considerable time past the disintegration of the cliff has been equal in equal times, the accumulation of stones above the Roman stratum is an index to the date of the lower horizon. This amounts to a maximum of 2 ft. If, then, in 1,200 years—to put it at the lowest—only a thickness of 2 ft. has been accumulated, it would take 3,600 years for a deposit of 6 ft. to be formed. And thus the harpoon and flint stratum would be about 4,000 years old, allowing about 400 years for the accumulation of that which contained Roman remains. The accuracy of this calculation is indeed injured by the possibility that the winter cold was more intense, and the splitting action of the frost greater then, than during the last 1,200 years. Nevertheless, the change from the Arctic severity of the post-glacial winter to the climate which we now enjoy in Britain has been so gradual, and spread over such a length of time, that it may be assumed to have been very small in so short a period as 4,000 or 5,000 years.—*Paper read before the Manchester Literary and Philosophical Society.*

THE CASMALOS (*MICROGLOSSUS ATERRIMUS*).

THE CASMALOS.

THE Casmalos (*Microglossus aterrimus*), the best known of the Long-billed Parrots, is an inhabitant of New Guinea, and is one of the largest of the parrot tribe, even exceeding most of the Araras in this respect. Its plumage is uniformly deep black, with somewhat of a greenish gloss; the living bird has a greyish appearance, owing to a white meal-like dust, which, as in most other parrots, is scattered over its plumage. The naked wrinkled cheeks are of a red colour. The crest is formed by a number of long, slender, isolated feathers, and is of a lighter grey than the rest of the plumage.

Little is known of these birds in their natural state. "The large-beaked parrot," says Von Rosenberg, "is not rare in the islands of Waigui, Misool, and Salawatti, and is found on the coast of New Guinea. It usually perches at the very top of the highest trees, keeping its body constantly in motion; and whilst resting, or when by powerful strokes of its wings it raises itself into the air, it utters a trumpet-like note quite different from that produced by the white cockatoo. The natives take the young birds from the nest, and, when they have reared them, sell them to traders. In captivity they seem to prefer the fruit of the canary-tree, the hard shell of which they manage to crack with the utmost facility. One of these so-called cockatoos, belonging to a resident in Amboyna, was in the habit of flying about all over the town, but always returned home at the proper time to take its meals and to sleep." Von Marten saw a tame parrot of this kind at Mahai. "The black cockatoo," he observes, "when perched stiffly with its tail erect, red face, and powerful beak, has the air of an old general, and, owing to its extreme ugliness, makes a forcible impression on all who see it. It is quiet and slow in its movements, but allows strangers to approach, and utters from time to time a disagreeable, harsh, guttural shriek."

According to Rosenberg, the Large-beaked Parrot is often seen at Amboyna, where it may be bought for about twenty-five shillings: in Europe these remarkable birds are amongst the greatest curiosities in our collections. Unlike all other parrots with which we are acquainted, the Casmalos uses its peculiarly-formed tongue in a strange manner. Taking its food with its foot it carries the morsel to its beak, tears it up, and presses the end of the tongue, which is provided with a round horn-like plate, upon the pieces, which stick to it; the tongue is

then drawn in, and the food swallowed. This being a very slow process, the meal usually occupies a considerable time.—*Cassell's Book of Birds.*

REVIEWS OF BOOKS.

A Manual of Zoology for the Use of Students. With a General Introduction on the Principles of Zoology. By Henry Alleyne Nicholson, M.D., D.Sc., M.A., Ph.D., F.R.S.E., F.G.S., &c. Vol. I. Invertebrate Animals. London: Robert Hardwicke. 1870.

STUDENTS' text-books are not so plentiful on Zoology as they are on some other sciences, and there is certainly room for another.

The one we are about to notice exhibits no attempt at any new method of considering the subject, and makes the fact a little too evident in its pages of its being a compilation. As stated in its title-page, a general introduction on the principles of zoology precedes the systematic account of the divisions and sub-divisions of the invertebrate animal kingdom.

This introduction is divided into fourteen sections, and discusses the meanings of such terms as Biology, Zoology, Morphology, Homology, Homomorphism, Life, Vital Force, Organized and Unorganized Bodies, Plants and Animals, Species, Genus, &c. It also contains an account of the different modes of Reproduction, of Development, of the Origin of Species, of Spontaneous Generation, and other kindred matters.

We do not much like this part of the book. Very difficult subjects are brought in it before the student at the time when he is supposed to be only commencing his study of zoology, and when therefore it is almost impossible to gain clear ideas concerning them. Moreover, the author has endeavoured to give a condensed account of these matters; and, what with the cut-and-dried results of this, and the unfamiliarity of the student with the facts in natural history which have led to the development of a knowledge of these principles, the latter is more likely to get into despair at the difficulties of his new study than he is to find his path made clear for a fair entry into it by this "introduction." We should like to see at least one-half of it cut out of the book: the place of this might be advantageously replaced by the elements of general anatomy.

The differences between organized and unorganized bodies are one of the first things treated of. A well-known writer on physiology is pretty closely followed; nevertheless, this section of the Introduction is very unsatisfactory. The terms "organized" and "organic," "unorganized" and "inorganic" are used indifferently for each other; and, consequently, the distinctions—so far as such there be—between organic and inorganic bodies, are incorrectly or meaninglessly applied to organized and unorganized bodies. As to the distinction between "organized" and "unorganized," the student will either know the meaning of the term "organized," or can easily find it in any good dictionary, and can therefore want no help in distinguishing between the presence and absence of organization. Dr. Nicholson is in reality trying to point out the distinctions between living and dead matter—not organized and unorganized bodies.

Then comes a section headed the "Nature of Life," which is, of course, unsatisfactory. How could it be otherwise on such a subject? Life as a function of protoplasm, the relation of life to organization, and the existence of a vital force, are all touched upon in this section.

Passing on to the body of the work, treating of Systematic Zoology, we find it much more satisfactory than the introduction to it. It is, in fact, a well-arranged description of each group, giving its definition, its anatomy, relations, &c.; its divisions into lesser groups, and its distribution in time and space. And it is not behind its time in its matter, taking due notice of the more important facts and views recently made known.

The work is concluded by a rather extensive etymological glossary. As a whole, Dr. Nicholson's manual is a very useful addition to the library of the student, who will find in it, we think, a very excellent guide to the study of the invertebrate animals. The introductory portion, to which we have raised objection, forms only a very small part of the entire volume, and if the student avoids this until he has made some progress in his studies, he may then probably go through it with considerable advantage.

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A Cigar-making Machine.—On the authority of *Cosmos* we learn that a machine working by steam has been invented in New York which does nearly all the work usually performed by male and female hands. It cuts the leaves, puts together the parts for the interior, and rolls up the cigar and glazes it. A single workman, who has only to moisten and gum the outside leaf, can make nearly two thousand an hour by the new process.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

Amphisaurus, Strepsodus, Ctenodus, &c.—*From* T. P. Barkas, F.G.S.

Sir,—Notwithstanding the inclemency of the weather, reptile and fish remains continue to be found in various collieries in Northumberland; and the recent accessions to my cabinet have been of a most interesting and rare character. I have obtained another portion of the ramus of *Pteroplax cornuta;* it is the posterior extremity of a left mandible; the articular cavity is perfect, and the markings on the surface of the jaw are very clear and well defined. There are not any teeth in the fragment, but it is valuable as a specimen of the genus of smaller size than was that represented by the perfect mandible in my possession, and previously referred to in Scientific Opinion. The interior surface of the jaw, which is beautifully represented in this fragment, is comparatively smooth, and the bone, although compact, is not thick.

I have also obtained what to me is yet more interesting, viz., three well-exposed portions of a premaxilla and mandible of the rare coal-measure fish Strepsodus, a description of which appeared on p. 556, vol. i., and p. 13, vol. ii., of Scientific Opinion. On this occasion I have secured two large portions of a large mandible; the tooth near the point of symphysis is long, slender, black, free from striations, and highly polished, and presents the uncurved aspect. The smaller teeth are about one-third the length of the longer tooth, and are longitudinally striated; the second portion of the same mandible possesses six teeth, one being large and five small. The premaxilla has a long, deeply-grooved, flattened, and much recurved tooth near the anterior extremity, and posterior to it are four small teeth, with the ordinary characters of Strepsodus teeth. The jaw I previously described exhibited but one aspect clearly; these specimens now before me expose the outer aspect of the jaws, and they exhibit the appearance of very rough shagreen, being covered with well-defined tubercles, somewhat resembling those of Coccosteus, but more rough and irregular. The teeth of Strepsodus resemble in form those of the Devonian fish Macropetalichthys. I have also added to my specimens of Megalichthys a mandible of *M. coccolepis*, a new species, named by Mr. J. Thompson at the last meeting of the British Association.

The spines of Orthocanthus and of Ctenacanthus are very rarely found in the Northumberland coal shale, and when they are obtained it is usually in a very fragmentary and imperfect condition. I have during the past two years obtained but two specimens of Orthocanthus and four of Ctenacanthus; two of the latter are merely broken fragments, one is a complete dorsal spine, and the fourth, which I have got within the last few days, is a perfect and most peculiar spine of that little understood coal-measure fish. The ichthyodorulite in question is resting in a fine level slab of shale; the length of the spine is 11 in., and the form is very peculiar, and different from any that I have previously seen figured or described in Agassiz's *Poissons Fossiles*, or elsewhere. It is difficult without an illustration to describe the precise form of the spine before me, but I shall endeavour to do so as clearly as possible. The spine consists of two parts, which are organically united at the root and apex; one of the portions of the double spine is nearly straight and approaches the circular form; the diameter of the body of the spine near the base is 1¼ in., and near the apex it is ¾ in., and terminates obliquely abruptly. Except at the root or part of attachment the spine is covered with longitudinal, finely denticulated ridges, which extend from base to summit in nearly parallel lines. A remarkable peculiarity which characterizes the spine is its possession of two *alæ*, or wing-like processes, which both proceed from what appears to be the posterior part of the spine, and extend from end to end. One of the wings is organically united with the body of the spine from the base to the summit, the other is united at root and apex only. The wings correspond in size and form, and are covered on the outer sides by denticular ridges resembling those that cover the true or central spine; the length of each wing is 11 in., the depth at the centre 1⅜ in., and the thickness of each is ¾ in. This peculiar conformation of the spine appears to have been for the attachment and infolding of the fin in a manner resembling the infolding of the body of a fan. The spine, judging from its size, was probably pectoral in position, and the fin which was associated with it in all probability passed between the two wings, and was fixed to the body of the spine between the spine and the wings, thus securing by one contrivance a firm base of attachment and a place of security for the fin when it was folded and not in use.

Since my last communication on ichnology was forwarded, I have discovered some rare, and it may be unique, impressions upon the arenaceous shale which lies in contact with what is locally termed "post" in our true coal-measures. The slab of arenaceous shale upon which the impressions have been produced is of very irregular outline, and is 11½ in. long by 11 in. broad. The impressions upon it vary much in size, the largest single impressions being ½ in. in diameter and the smallest ⅛ in. The depths of the indentations vary from ½ in. to a merely visible depression. The surface of the slab is ridged by four elevations resembling smooth ripple ridges and there are four shallow intervening depressions. The impressions for the most part cross the slab in irregular longitudinal lines, corresponding generally with the directions of the ripples. A few impressions pass with a slight obliquity across the ripple-marks. The deep depressions are mostly on the ridges and the more shallow depressions are in the furrows.

After a careful examination of the specimen I am of opinion that the impressions are produced partly by rain or hail and partly by tracks of animals, whether reptiles or mammalia. I am not prepared to determine, but certainly not by birds, as none of the impressions present the slightest ornithic characteristic.

The really well-defined foot-marks are three in number, the moderately well-defined foot-tracks number four, the ill-defined foot-marks are about eight in number, and the total number of impressions upon the slab (reckoning the four toes and heel which form one foot-print as five) are 135, of which number 20 are small and faint. The well-defined foot-marks indicate a heel and four toes. Some of the foot-prints bear a slight resemblance to those of Sauropus which was discovered at the base of the Pottsville coal-measures, Philadelphia, by Mr. Isaac Lea; some, and those are probably rain or hail-marks, resemble the representations of *Protichnites 7-notatus* which are supposed to have been produced by crustaceans of the Cambrian epoch; and others are unlike anything I have seen either illustrated or described, the chief characteristic being a well-marked heel and four well-marked toes.

I do not know anything with which I can compare some of the foot-prints to which I am referring, and in the absence of illustrations I cannot do better than offer a cordial invitation to inspect them to any ichnologist or palæontologist who desires to make further acquaintance with these interesting memorials of the life and meteorological histories of a long past era.

"Post," or sandstone, rests upon the sandy shale on which the footprints are impressed, and, so friable is the sandstone, that in many instances it has snapped off level with the surfaces of the impressions, and the sandstone remains in the depressions. The compact sand which fills some of the impressions, is of a white-grey colour; the particles of which it consists are very minute, and mixed with these are several glittering fragments of mica. It closely resembles the fine sand that is blown about upon our sea-beaches during a dry wind storm.

It is extremely probable that the "post," which rested upon our foot-impressed and rain-indented sandy shale, was carried to its destination by a strong wind, and this hypothesis is the more probable, as the entire surface of the shale is covered by small pittings, such as would be made by the larger particles of sand falling or resting upon a moist semi-muddy surface.

The foot and rain impressions have been made prior to the fall of the sand shower, as the indentations of the larger particles of sand cover the foot and rain impressions in the same manner as they cover the general surface of the slab.

While examining the cabinet of a local palæontologist a few days ago, I observed, among many rarities and valuable specimens a very beautiful portion of a jaw of the new reptile *Amphisaurus amblyodus*. The fragment contains five teeth, and has all the characteristic peculiarities of the specimen from which the reptile derived its name. This is the third jaw of Amblyodus with which I am acquainted, one having been obtained in Staffordshire and two in Northumberland.

In the same cabinet I saw several specimens of Ctenodus, which may be classified under the specific name of *tuberculatus;* but although classified as *tuberculatus* the species should at least be separated into several varieties. Undoubted specimens of *C. tuberculatus* have come under my observation with 15, 13, 12, 10, and 9 ridges; in some of the specimens the ridges radiate, in others they cross the teeth at right angles to their major axes, and in others they cross obliquely in one direction. One instructive group in the cabinet referred to consists of two upper, large, concave teeth of *C. tuberculatus* laid symmetrically on each side of a median line; they are attached together by a thin flat plate of bone—which, in their case, was unquestionably the original surface of attachment for the teeth—they therefore differ from other well-exposed upper teeth of *C. tuberculatus*, and tend to support the inference that, although Dipterus of Miller had but four teeth, or ridged bony denticular plates, some of the Ctenodi probably had a larger number. The cabinet containing these excellent specimens is the property of a working miner who, for several years, has devoted his leisure hours to searching for fossils, classifying them, and preparing them for microscopical examination.

I am, Sir, yours obediently,

Newcastle-on-Tyne, March 29. T. P. Barkas, F.G.S.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THE following is the conclusion of Dr. Davies's paper continued from last week's SCIENTIFIC OPINION, p. 351:—

Returning from this digression to the immediate subject of this paper, we have to consider the cause of the differences in the areas of the four principal orifices of the heart.

The right and left sides of that organ are, to all intents and purposes, two distinct and perfect hearts, discharging individually their own proper functions, but associated in one common interest by certain bands of muscular fibres and interoommunicating nerve-ganglia. Now, if these two hearts had exactly equal tasks to perform and were simply designed to propel the contents of their ventricles to equal distances and with equal velocities, if, in a word, they had been intended to overcome equal obstacles in the pulmonic and systemic circulations respectively, their walls would have undoubtedly been constructed of equal thickness, and the corresponding orifices of the two sides would have been of equal areas, the tricuspid being equal to the mitral, and the pulmonic to the aortic aperture. But as the left ventricle has to propel the blood to far greater distances, and to overcome obstacles much greater than those found in the pulmonic circulation, the velocity and force of the stream sent from the left must be evidently greater than the velocity and force of the blood thrown out by the right ventricle. To secure this result, I need scarcely say that the left is rendered considerably thicker and stronger than the right ventricle by the greater development of its walls; *but here* we must bear in mind the *cardinal fact* (the key to the entire question) that, whatever be the velocity and force of the streams issuing from the two ventricles, the *quantities* of blood expelled by the synchronous contraction of the two chambers must be exactly the same, or else accumulation in the pulmonic or systemic systems will ensue, and the machine be brought to a standstill.

As, therefore, the two ventricles contracting with *unequal forces* have to expel *equal quantities* of blood in *equal and the same time* to *unequal distances* and to overcome *unequal resistances*, the perfect synchronism of the ventricular contractions can be only obtained by an exact graduation of the areas of the orifices of the aortic and pulmonary artery to the muscular forces respectively impressed upon the contents of the two ventricles in systole, and consequently to the velocities of the streams issuing from those chambers. The area of the aortic must be therefore smaller than the area of the pulmonic, and *in such proportion* that the normal average contents (say three ounces) of the left ventricle shall occupy exactly the same time in passing through the aortic as is required by the three ounces of the right ventricle in passing through the pulmonic opening. The greater muscular power of the left, as compared with that of the right ventricle, causes a corresponding greater velocity and force of the column of blood issuing from its outlet, while the smaller area of the aortic, as compared with that of the pulmonic opening, exactly equalizes the times occupied by the contractions of the two chambers. Without such an arrangement in the comparative areas of the two outlets, it is clear that the stronger left would completely empty itself before the right ventricle had accomplished the same function, and the synchronizing action of the two hearts would be thus rendered impossible. Equal quantities of blood are, however, in the way described, made to pass exactly synchronously through the aortic and pulmonic openings, but with, of course, unequal velocities, the blood particles which traverse the narrow aortic travelling with greater speed than those which pass through the larger pulmonic orifice. Mathematically expressed, the velocities of the streams through the orifices are inversely as the areas of those orifices, or

$$\frac{\text{velocity through aortic opening}}{\text{velocity through pulmonic opening}} = \frac{\text{area of pulmonic opening}}{\text{area of aortic opening}}.$$

And if we assume the mean measurements of the orifices found in the former part of this paper to be correct,

$$\left.\begin{matrix}\text{the velocity through}\\ \text{aortic opening}\end{matrix}\right\} = \frac{1 \text{ sq. in.}}{\cdot 75 \text{ sq. in.}} \times \text{velocity through pulmonic opening}$$

$$= 1\cdot 3 \text{ times the velocity through pulmonic opening,}$$

$$= 1\tfrac{1}{3} \text{ times the velocity through pulmonic opening,}$$

or, in other words, the velocities of the currents through the aortic and pulmonic orifices are in the ratio of 4 to 3.

The arguments which I have advanced respecting the aortic and pulmonic will be equally applicable to the tricuspid and mitral openings; for—

1st. The two ventricles are exactly synchronous in their diastole, receiving their respective charges of blood from the auricles in exactly equal and the same times.

2nd. Equal volumes of blood enter the two ventricles during their diastole, or else accumulation and stagnation would ensue: I am speaking here of healthy ventricles.

3rd. The ventricles are of equal capacities; but

4th. As the currents which traverse the tricuspid and mitral orifices are of unequal velocities, the areas of those openings must be of such magnitudes that equal volumes of blood must pass through them in exactly equal and the same times. The tricuspid having a slower velocity than the mitral current, will necessitate the area of the tricuspid being proportionally larger than the area of the mitral orifice. In a word, the synchronous dilatation of chambers admitting equal volumes of blood must entail such a relation of area between the two inlets that

$$\frac{\text{the velocity through tricuspid}}{\text{the velocity through mitral}} = \frac{\text{area of mitral}}{\text{area of tricuspid}}.$$

And if we assume the measurements previously found to be correct,

$$\text{the velocity through tricuspid} = \frac{1\cdot 25}{1\cdot 75} \text{ velocity through mitral,}$$

$$= \tfrac{5}{7} \text{ velocity through mitral,}$$

i. e., the velocities of the currents of the blood in diastole through the tricuspid and mitral orifices are in the ratio of 5 to 7.

It may be fairly asked what proofs can be given that the velocities of the currents of blood which traverse the tricuspid and mitral orifices are unequal, and that the mitral in-coming stream possesses a stronger ventricular dilating power than the current which enters the tricuspid to expand and fill the right ventricle. I shall refer to this point shortly; but, whatever may be the value of the reasons that will be adduced in support of the above view, there can be no doubt, *in fact*, that the two orifices in healthy hearts always differ in size, and the synchronous expansion of ventricles with unequal inlets must inevitably lead to this result—that the larger must admit a current of correspondingly smaller velocity than that which traverses the smaller opening; or, mathematically expressed, the velocities of the in-coming tricuspid and mitral streams must be inversely as the areas of the orifices.

From the data at which we have arrived, and estimating the mean amount of the ventricular contents at three ounces (or five cubic inches, nearly), although it must be confessed that this is an uncertain estimate, we may readily calculate the average velocities of the currents which traverse the four orifices. We shall consider the pulse to beat at the rate of 70 per minute, and the points of ventricular contraction and dilatation to be in the ratio of 1 to 2, *i. e.* the ventricular contraction occupying one-third of the time between two pulses; *i. e.*,

$$= \tfrac{1}{3} \text{ of } \tfrac{1}{70}' = \tfrac{1}{210}'.$$

1. *Aortic Orifice.*

$$\text{Velocity through aortic orifice} = \frac{\text{volume expelled in } \frac{1}{210}'}{\text{area of aortic orifice}}$$

$$= \frac{5 \text{ cub. inches}}{\cdot 75 \text{ sq. inches}} \text{ in } \tfrac{1}{210}'$$

$$= 6\cdot 6 \text{ inches in } \tfrac{1}{210}'$$

$$= 23\cdot 1 \text{ inches in } 1''$$

$$= 6\cdot 6 \times 210 \text{ inches in } 1'$$

$$= 1386 \text{ inches per minute.}$$

2. *Pulmonic Orifice.*

$$\text{Velocity through pulmonic orifice} = \tfrac{3}{4} \text{ velocity through aortic opening}$$

$$= 17\cdot 3 \text{ inches per second}$$

$$= \tfrac{3}{4} (1\cdot 3) \text{ mile per hour}$$

$$= \cdot 97 \text{ mile per hour}$$

$$= 1 \text{ mile per hour, nearly.}$$

3. *Tricuspid Orifice.*

$$\text{Velocity through tricuspid} = \frac{5 \text{ cub. ins.}}{1\cdot 75 \text{ sq. in.}} \text{ in } \tfrac{2}{3} \text{ of } \tfrac{1}{70}'$$

$$= \cdot \tfrac{1}{35} \text{ inch in } \tfrac{1}{105}'$$

$$= \tfrac{105}{35} \text{ inch in } 1'$$

$$= 5 \text{ inches per second.}$$

$$= 300 \text{ inches per minute}$$

$$= 8\tfrac{1}{3} \text{ yards per minute.}$$

4. *Mitral Orifice.*

$$\text{Velocity through mitral} = \tfrac{7}{5} \text{ velocity through tricuspid}$$

$$= 7 \text{ inches per second}$$

$$= \tfrac{7}{3} \text{ of } 500 \text{ yards par hour.}$$

The mean velocities of the currents of blood traversing a healthy

heart with the dimensions of the areas as given above, are as follows:—

	yards.	inch.
Aortic	= 2310	= 1·3 per hour
Pulmonic	= 1725	= 1 nearly
Mitral	= 700	= ·4
Tricuspid	= 500	= ·28

In such a heart we see, therefore, that the blood enters the tricuspid orifice at the rate of nearly ¼ mile per hour, and leaves it through the aortic orifice at the rate of nearly 1¼ mile per hour; and that the velocity, therefore, of the tricuspid in-coming current is only one-fifth of the velocity of the stream which passes through the aortic orifice.

Without entering into arithmetical details, such a result as the above is easily arrived at when we bear in mind the facts that the same quantity of blood passes through the two openings, but that while the tricuspid is, according to Dr. Peacock, 2½, and according to Dr. Reid nearly three times larger than the aortic orifice, the flow of the three ounces through the former occupies nearly twice the time required by the passage of the same quantity of blood through the latter opening. The tricuspid is nearly three times larger than the aortic aperture, and is open for the transmission of the same volume of blood more than double the length of time occupied by the latter opening. Hence the comparative slowness of the in-coming tricuspid current.

These speculations upon the absolute and relative velocities of the currents of blood through the heart are not without practical value, inasmuch as they have a direct bearing upon the question of the amount of pressure exerted by that fluid in each chamber of the organ, and are links in the chain of reasoning respecting the comparative areas of the four orifices. The first-recorded experiments to determine this pressure were made by Dr. Stephen Hale, F.R.S., and were published by him in his *Statical Essays* in 1732. Thus, when tubes were fixed into the crural artery and jugular vein of different animals, the heights to which the blood rose were found to be as follows:—

	Artery.	Vein.
Horse	114	12
Sheep	77½	5·3
Dog	48	4·3

These experiments were, of course, rather roughly made and without modern appliances; but they serve to show that the pressure of the blood in the jugular vein is only one-ninth to one-fourteenth of the pressure observed in the arterial side of the circulation. Valentin, by means of the hamadynamometer, estimated the pressure in the jugular vein to be one-tenth to one-twelth of the pressure in the carotid artery, and "in the upper part of the inferior vena cava could scarcely detect the existence of any pressure, nearly the whole force from the heart having been apparently consumed during the passage of the blood through the capillaries" (Kirkes and Paget).

It is thus sufficiently clear, experimentally, that the velocity and momentum of the blood which enters the right auricle and finds its way into the right ventricle must be very small in comparison with the rapidity and momentum of the current issuing from the left ventricle; and we can therefore, from this fact, understand that the tricuspid is constructed of much greater area than the aortic opening, in order that its much larger orifice may compensate for the comparatively sluggish stream which it has to transmit. It is evident enough why the blood which has returned to the right heart possesses so small an amount of velocity and momentum. In its passage through the systemic circulation it has encountered and overcome an amount of obstruction which, by the time it has arrived in the right auricle, has deprived it of the greater portion of the velocity and momentum which it had derived from the contractile energy of the left ventricle, assisted, as that power has been, by the muscular pressure on the veins of the body. The columns of blood from the superior and inferior venæ cavæ enter the auricle, therefore, slowly, and with small force, but with an amount of velocity and momentum exactly adapted to and sufficient for the expansion of the right ventricle. It cannot be for one moment maintained that the right is weaker than the left heart in proportion to the work to be done by the respective sides, for each organ is exactly adapted to the task which it has to perform, and the perfection of the mechanism is as manifest in one as in the other side of the heart. The right side is undoubtedly exposed to sudden and great variations in the amount of blood-pressure to which it is from time to time subjected; but there can be no reason for believing that provision has not been made for such variations *within due limits*. In fact, daily experience shows us how the right side will maintain its vigour unimpaired, although severely and often tried by the alterations in the blood-pressure resulting from rapid walking, running, pulling at the oar, and the usual athletic exercises. The slowness of the current which returns to the right side, the large area of the tricuspid orifice, and the comparatively long period of time during which the ventricle is open to receive its contents, evidently confirms the view that the right ventricle offers but little resistance to the in-coming current, and that a stream of small velocity and momentum is amply sufficient to fill and complete the expansion of that chamber. The force which is exerted by the contraction of the auricle is small, and in operation for a short period of time ($\frac{1}{5}$ to $\frac{1}{10}$ of a minute), and is chiefly of use, I believe, in completing the closure of the tricuspid valve in the manner described by Baumgärtner, Valentin, and Halford. It must be also borne in mind that the particles of the blood-stream which have entered the tricuspid orifice in a direction nearly at right angles to the axis of the pulmonary artery must, when the ventricle has become filled, change their direction of motion to find their way in systole out of the ventricle. At the end, therefore, of the diastole I imagine that the whole of the contents of the ventricle is at rest (momentarily, but not less really so), and ready to take up a new movement in a course nearly at right angles to its line of entrance from the auricle. If this view, which has escaped the attention of physiologists, be correct, we observe an additional reason for the blood which enters the ventricle possessing an amount of velocity and momentum just sufficient, and no more, to complete the dilatation of the chamber, and having performed its task, to assume for a moment an attitude of repose before the contraction of the ventricle sends it forth in a different direction. All force in the human body is economized, the means is strictly adapted to the end, the left ventricle puts forth power sufficient to carry the blood through the systemic capillaries to the right side of the heart, the blood enters the right auricle with an amount of pressure sufficient, with the aid of the auricular contraction, to fill the ventricle; and should any excess of momentum exist, it is probably annihilated by the in-coming current meeting the dense interlacement of the fibres of the columnæ carneæ which form such prominent parts of the interior of both ventricles. It is interesting to observe that this interlacement is most dense near the apex, where the in-coming current impinges with greatest force, and where the excess of momentum of the blood can be easier annihilated before it changes its direction of motion to escape in systole from the chamber. The remarks which belong to the right are equally applicable to the left ventricle, and lead to the conclusion that the current entering through the mitral orifice, as soon as the chamber is filled, loses its mobility for a moment before the contractile force of the ventricle launches it forth in a totally different direction through the aortic opening into the systemic circulation.

I will now return to the statement which I had left unproved, that the velocities of the synchronous tricuspid and mitral currents are unequal, and that the latter possesses a stronger ventricle-dilating power than the former.

The argument to establish this point is very brief.

The two ventricles being of unequal thickness and containing consequently unequal quantities and weights of muscular fibre, will necessarily require currents of blood of unequal momenta to overcome their respective *vis inertia*, fill their chambers, and complete their dilatation in exactly equal and the same times. That is,

> the momentum of the mitral is greater than the momentum of the tricuspid current;

or, in other words,

> the volume of the mitral column multiplied by its velocity *is greater than* the volume of the tricuspid column multiplied by its velocity;

but the volume of each current *is the same*; hence, eliminating *volume* from each side of the above, it is evident that

> the velocity of the mitral is greater than the velocity of the tricuspid current,—the conclusion which was to be demonstrated.

In concluding this paper, I would very briefly recapitulate the conclusions at which I have arrived. I have proved, from the measurements of the orifices made by Drs. Peacock and Reid, that the areas of the openings in man are subject to a constant law, summarily expressed thus:—

$$\frac{T}{M} = \frac{P}{A}.$$

And the same result I have also obtained from my own measurements of the healthy heart. Furthermore, I have proved, from my own measurements, that the same law probably regulates the areas of the orifices in animals generally; and I have cited several examples in corroboration of the statement. From the existence of this law, it is clear that if the areas of any three healthy orifices be known, the area of the fourth can be determined by calculation.

I have then drawn attention to the curious and important fact which appears to be almost general in animals, that

$$\frac{T}{M} = 1{\cdot}3 \text{ to } 1{\cdot}4, \text{ nearly};$$

and

$$\frac{P}{A} = 1{\cdot}3 \text{ to } 1{\cdot}4, \text{ nearly};$$

consequently that the dimensions of the openings of one side of the

heart being given, the areas of the corresponding orifices on the other side of the organ may be obtained by arithmetical process.

Having shown from measurements that the orifices arranged in the order of their magnitude are as follows,

1. Tricuspid,
2. Mitral,
3. Pulmonic,
4. Aortic.

I have sought to determine the reasons for this arrangement, to which, however, I shall not again refer.

I propose on some future occasion to show how widely this "*law of the orifices*" which I have discovered is applicable to the heart-diseased state, and how it serves to explain many important and interesting points relative to the organ. I shall conclude with citing a few instances of disease in which its application throws some light on the effects of pulmonary disease upon the areas of the orifices.

1. *Phthisis* (Dr. Peacock).

	Circumference.	Area.
Tricuspid	51 lines.	207 square lines
Pulmonic	39	121
Mitral	18	183
Aortic	36	103

$$\frac{T}{M}=\frac{207}{183}=1{\cdot}13,$$

$$\frac{P}{A}=\frac{121}{103}=1{\cdot}17$$

Difference of the ratios = ·04

2. *Phthisis* (Dr. Peacock).

	Circumference.	Area.
Tricuspid	43 lines.	147 square lines
Pulmonic	29	67
Mitral	37	109
Aortic	26	54

$$\frac{T}{M}=\frac{147}{109}=1{\cdot}35$$

$$\frac{P}{A}=\frac{67}{54}=1{\cdot}25$$

Difference of the ratios = ·10

3. *Bronchitis* (Dr. Peacock).

	Circumference.	Area.
Tricuspid	60 lines.	286 square lines
Pulmonic	45	193·07
Mitral	54	232·1
Aortic	26	103·18

$$\frac{T}{M}=\frac{286{\cdot}6}{232{\cdot}1}=1{\cdot}235$$

$$\frac{P}{A}=\frac{193{\cdot}07}{103{\cdot}18}=1{\cdot}870$$

Difference of the ratios = ·635

In these two cases the orifices evidently closely exhibit the usual normal relation to each other; and as the blood in phthisis emanates and diminishes in quantity like the other parts of the body, we should not expect in a pure case of phthisis an amount of pulmonary obstruction sufficient to produce marked alterations in the areas of the openings.

The relation is clearly abnormal.

T and M are nearly in normal relation to each other, but P is abnormally large in relation to A. This heart was enlarged (weighed 14 ounces) from hypertrophy and dilatation of its right side, and the pulmonic orifice, from the abnormal increase of the pressure of the current of blood sent through it by the thickened right ventricle, became considerably dilated.

4. *Bronchitis* (Dr. Davies).

	Circumference.	Area.
Tricuspid	5 in.	2 sq. in.
Pulmonic	3·5	·975
Mitral	3·8	1·15
Aortic	3·1	·79

$$\frac{T}{M}=\frac{2}{1{\cdot}15}=1{\cdot}74$$

$$\frac{P}{A}=\frac{{\cdot}975}{{\cdot}79}=1{\cdot}24$$

Difference of the ratios = ·50

The tricuspid is evidently abnormally large in relation to the mitral orifice.

If we suppose the other three orifices to be nearly normal (and it is evident that the pulmonic and aortic bear their normal relation to one another), we can calculate the excess of dilatation exhibited by the tricuspid opening

$$\frac{T}{M}=\frac{P}{A};$$

$$\therefore T=1{\cdot}15\times\frac{{\cdot}975}{{\cdot}79}=1{\cdot}42 \text{ sq. inch.}$$

Hence the tricuspid is ·58 in. in excess of its normal area, or more than one-third of its proper size in excess.

5. *Bronchitis* (Peacock).

The heart in this case weighed eleven ounces. As this does not much exceed its usual weight, it is clear that the pulmonic obstruction was slight. We should therefore expect to find but little deviation from the "law of the orifices."

	Circumference.	Area.
Tricuspid	62 lines.	306 sq. lines.
Pulmonic	45	161
Mitral	54	232
Aortic	39	121

$$\frac{T}{M}=\frac{306}{232}=1{\cdot}32$$

$$\frac{P}{A}=\frac{161}{121}=1{\cdot}33$$

Difference of the ratios = ·01

This result fully bears out the inferences above made.

CHEMICAL SOCIETY.[1]

April 7th.—Prof. Williamson, F.R.S., in the chair. The following gentlemen were elected fellows:—F. Andrews, jun., W. Martindale, A. H. Palmer. Dr. Divers concluded his paper "On the Combinations of Carbonic Acid with Ammonia and Water."—This elaborate and very extensive memoir does not admit of any abbreviation. Readers desiring more information are therefore referred to the *Journal of the Chemical Society*, which will, in one of the next numbers, publish Dr. Divers's investigations.

Dr. Gladstone communicated a paper "On the Refraction Equivalents of the Aromatic Hydrocarbons, and their Derivatives."—In a previous paper (read before the society on March 3rd) it was shown that, having ascertained the refraction equivalents of carbon, hydrogen, oxygen, nitrogen, and chlorine, the refractive values of a large number of compounds, built up by those elements, may be calculated with a close approximation to the truth. In the present paper, Dr. Gladstone treats with the exceptions to that rule. Phenylic acid, oil of bitter almonds, salicylic acid, methylic salicylate, methylic benzoate, ethylic benzoate, benzol, toluol, xylol, cumol, cymol, carvol, eugenic acid, pyridine, chinoline, aniline, nitrobenzol, chlorobenzol, naphthalin, and many others, yet give by experiment much higher refractive values than by calculation. A glance at the names of these exceptional substances will show that they consist of the aromatic hydrocarbons, with the bodies derived from, or related to, them. The refraction equivalents of the hydrocarbons themselves, and their chlorine substitution products, are about 6·0 above what theory requires; the compounds from creosote are a little higher still. The azotized products, and those containing C_7, are very nearly 8·0 above the calculated values, and hydride of cynnamyl is well known to be among the most refractive and dispersive of bodies. To what can this increased refraction be attributed? Dr. Gladstone thought first that the hydrogen in benzol and its congeners or derivatives might have a refraction value of 3·5, as in the hydracids of the halogens; but on investigating chlorhydranil, $C_6Cl_4O_2H_2$, where the greater part of the hydrogen is replaced by chlorine, and where the existing hydrogen is considered not to belong to the nucleus, a fraction equivalent of 7·6, that is, about the usual amount above the theoretical value, was obtained. Dr. Gladstone is now disposed to regard the nucleus, phenyl, C_6H_5, as an entity, having an unexceptionally great influence on the rays of light; and this augmentation of refractive power has its analogy to that change in the refraction value which certain elements (for instance, iron and phosphorus), undergo when they alter their atomicity. This entity is not destroyed by the replacement of its hydrogen by chlorine, nitric oxide, oxygen, or sulphur. When, however, this nucleus is subjected to such chemical change as to break it up, the resulting products have only the ordinary effect on light.

Taking the difference of the figures obtained by experiment, and of those by calculation, it is found that the group of essential oils give refractive values of about 2 higher than required by theory; the phenyl group about 6 above the theory; the naphthalin group about 14; and

[1] Extracted from the *Chemical News*.

the anthracen group about 17 above the calculated figures. Now, in these groups, the carbon increases in proportion to the hydrogen, and thus it becomes probable to arrange the above substances into certain series, which Dr. Gladstone regards, however, as merely a rough sketch, and by no means as a decided question. He hopes, at some future time, to say more on this subject.

Mr. Hunter, of Queen's College, Belfast, communicated a paper "On Analysis of Deep-Sea Water," a sequel to a note read before the society in December last.

Messrs. Bolas and Groves read a note "On the Convenient Preparation of Bromo-picrin." They also gave preliminary announcement of the discovery of tetrabromide of carbon.

Professor How had sent a memoir "On an Acid Feed Water from the Coal-field at Stellarton, Nova Scotia." The paper is chiefly remarkable by giving information of the presence of free oil of vitriol in the water which is used for feeding boilers.

INSTITUTION OF CIVIL ENGINEERS.

APRIL 12TH.—Charles B. Vignoles, Esq., F.R.S., president, in the chair.

The paper read was "On the Maintenance and Renewal of Railway Rolling Stock," by Mr. R. Price Williams, M. Inst. C.E. —The author began by stating that the experience now possessed, extending over nearly forty years, enabled the average life of each individual part of a locomotive and of other rolling stock to be accurately ascertained. Tables were submitted, based on data furnished by several engineers, showing in minute detail the average lives and the net cost of the several parts of an engine and tender of recent construction, and thence by calculation the mean money life of the whole structure was determined. It was shown that the lives of the different parts of the engine varied considerably, from the break-blocks and other small items, which required to be renewed every six months, to the side frames, plain axles and other parts which lasted thirty years. The first series of extensive renewals, which occurred at intervals of five years, consisted chiefly of the replacement of the brass tubes, and amounted during the period of longest life, or thirty years, to £973. The renewals of the crank axles followed in periods of six years, and cost, during the whole thirty years, £256. The great bulk of the renewals, however, took place at intervals of seven and ten years, and included the engine tyres, boiler, fire-box, and other costly portions, amounting altogether to £2,119 during the same period. The whole net cost of the renewals in thirty years amounted to £4,890 equivalent to an average cost of £163 per annum. The total net cost being £1,788, it followed that the mean money life[1] of an engine and tender of this type was 10·97 years, or, practically, 11 years. If the number of miles run were taken as the measure of life, and if 20,000 miles per engine per annum were assumed to be a fair average performance in steam, it followed that when an engine had run 220,000 miles, an amount would have been spent upon it in repairs equal to its first cost.

ETHNOLOGICAL SOCIETY.

APRIL 12TH.—Prof. Huxley, F.R.S., president, in the chair. It was announced that Dr. Bonavia had been elected a member of the society, Dr. Carl Semper an honorary foreign member, and Lieut. Oliver, R.A., a corresponding member.—A paper by Mr. Hodder M. Westropp described very fully the ancient tribal system and land tenure in Ireland under the Brehon laws, and gave rise to a spirited discussion, which was sustained by Mr. G. Campbell, Col. Lane Fox, the president, Dr. Hyde Clarke, and Mr. McLennan. A communication was then read "On the Danish Element in the Population of Cleveland, Yorkshire," by the Rev. J. C. Atkinson.—The author pointed out that not only many words in the Cleveland dialect, and a very large proportion of personal and local names in the district are of Scandinavian origin, but also that many of the idioms in use are markedly Scandinavian. He also sought to trace an old Anglian element in the population.—Mr. Jón Hjaltalin (an Icelander), Dr. Hyde Clarke, the Rev. Dr. Nicholas, and Col. Lane Fox, took part in the discussion which followed the reading of this valuable communication.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

ORDINARY MEETING, MARCH 22ND.—E. W. Binney, F.R.S., F.G.S., vice-president, in the chair. Mr. James Teale, of Springfield, Sale, was elected an ordinary member of this society. A letter from Mr. H. Wilde was read, stating that since the last meeting he had made a few experiments "On the Suspension of a Ball by means of a Jet of Water," and had found that the behaviour of the ball was the same in vacuo as it is in air.

Mr. R. Routledge stated that he had also made a few simple experiments, and had found that when a string was attached to the ball in such a manner as to prevent or impede its rotation about a horizontal axis, it was no longer continuously sustained by the jet. Also when the jet (directed horizontally to avoid the interference of the falling drops) was brought very near to the light ball suspended by a thread, the ball showed no tendency to move towards the jet. This invalidates the surmise that the jet is accompanied by a current of air which tends to carry the ball into the jet.

Professor Osborne Reynolds, B.A., said: After the discussion which followed my paper on this subject at the last meeting of this society, I thought it would be well to substantiate as far as I could the truth of my hypothesis by experiments; and the following is a description of what I have done in this way. Before describing the experiments I will mention the immediate objects for which they were severally undertaken. First, I wished to show that the air was not the medium by which the water acted on the ball, and this I have done by showing that the jet would produce no effect on the ball unless actually touching it. Secondly, I wished to show that the horizontal equilibrium of the ball was due to its rotation; and thirdly, to find the limiting positions of that point on the ball in which it might be struck and remain in equilibrium, and moreover the nature of the equilibrium.

The apparatus employed in these experiments consisted of a wheel 3 in. in diameter and ¼ in. broad at the rim, made of painted wood, capable of turning very freely about its axis, and suspended by two wires, with its axis horizontal, so that it could swing like a pendulum. A vertical jet of water was so arranged that it could be made to strike the reel at any point from below, or to miss it altogether. This was done by bringing the jet out of a horizontal pipe which would slide backwards and forwards in the same direction as the wheel could swing. This pipe was furnished with a cock, so that the force of the jet might be altered.

In experiment No. 1, the pipe from which the jet issues was pushed so forward that the jet missed the reel by about an inch, and the jet was turned on to rise about six feet above the reel; the pipe was then brought back until the water passed as near as possible to the reel without touching it—but there was no apparent effect produced on the reel. The tap was turned so as to increase and then diminish the height to which the jet rose—still, without any effect.

Experiment No. 2 was made with the same apparatus as No. 1. The reel was then changed for one six inches in diameter and the same experiment repeated.

The jet was placed so that it missed the reel (when hanging freely) by about two inches, and the water was turned on to rise about six feet. The reel was then pushed forward until it touched the jet and then let go; it immediately began to turn about its axis, but left the jet swinging backwards and forwards, touching the jet each time, and each time gaining in speed of rotation. This went on for several oscillations, but as it got to turn faster it appeared to stick to the jet for an instant before letting go, and having done this once or twice, it stuck to the jet altogether and remained in contact with it, spinning rapidly. The experiment was then repeated with the jet at different distances, and with the larger wheel: the result was the same in all cases. I found it possible, however, either to increase or to diminish the force of the jet enough to prevent the reel from remaining in contact with it. The limits were about 2 and 8 ft.

In experiment No. 3, the position of the reel when free was carefully marked, so that the least alteration could be noticed, and the jet was placed directly under its centre. In this position the jet did not cause the reel to move to either side in particular, but to oscillate backwards and forwards. The jet was then pushed slowly forwards, and the motion of the ball watched. At first it moved away from the jet slightly, and remained away until it was struck about 60° from its lowest point, after which it gradually came back to its initial position, which it reached when struck about 65° from its lowest point.

The forward motion of the jet being continued, the ball began to follow the jet; the point in which it was struck moving upwards very slowly. When the reel finally fell from the jet and came back into its initial position, the jet missed it by about 2½ in.

This clearly shows that the position of equilibrium is about 25° from the middle of the ball, and for any deviation below this point the equilibrium is much more nearly neutral than for any deviation above it.

During the experiment the force of the jet was altered, but within moderate limits this did not affect the position of equilibrium.

An extract of a letter dated March 21st, 1870, from Sir W. Thomson, D.C.L., F.R.S., hon. member of the society, to the president was read.

Mr. R. D. Darbishire, F.G.S., exhibited a number of beautiful specimens of electroplate reproductions of some of the Roman plate lately found at Hildesheim, and gave a summary of Mr. Wieseler's very interesting discussion upon this find.

"On the Determination of Phosphoric Acid," by William Carleton

[1] It was explained that by the term "mean money life" was meant that period during which a sum would have been spent upon the repairs and renewals exactly equal in amount to the net cost of an engine.

Williams, Student in the Laboratory of Owen's College, was a paper communicated by Professor Roscoe, Ph.D., F.R.S.

Mr. W. L. Dickinson communicated a paper containing the results of calculations relative to the three occultations of the planet Saturn by the Moon, April 19, July 10, and September 30, visible in England during the present year. The calculations have been made for the Observatory of the late Robert Worthington, Esq., F.R.A.S., Crumpsall, near Manchester, lat. 53° 30′ 50″ N., lon. 0ʰ 8ᵐ 56·10ˢ W.

A paper was also read, by Dr. Thorpe and Mr. E. H. Morton, "On the Composition of the Water of the Irish Sea."

CORK CUVIERIAN AND ARCHÆOLOGICAL SOCIETY.

The last meeting of this society for the session 1869-70 was held in the library of the Royal Cork Institution on Wednesday week, Richard R. Brash, Esq., M.R.I.A., president, in the chair.

"Explorations in the Shandon Limestone at Dungarvan."—Prof. Harkness, F.R.S., said, with the exception of the bones of the Irish elk, the remains of Pleistocene mammals are by no means common in Ireland. Of the Mammoth (*Elephas primogenius*) there are only three instances on record of its discovery in that country. The first of these was in 1817, when the teeth and bones of this animal were met at Maghera, near Belturbet, in the county Cavan. The second is recorded in Smith's *History of Waterford* (1746), where allusion is made to an elephant's rib discovered at Whitechurch, near Dungarvan; and the last is a valuable discovery of the occurrence of these remains in the lime-quarry at Shandon, near Dungarvan, by Mr. Brenan. Here other extinct mammal remains have been also found associated with those of the mammoth. The locality near Dungarvan which affords these remains has ceased to be worked for some years, and of late, consequently, nothing has been obtained from the spot. Remains of extinct mammals are, however, by no means uncommon at Shandon, as will be seen in the sequel. The position in which the bones of the mammoth have been found here is somewhat unique. The workmen who first discovered them all bear the same testimony, that they were derived from the solid rock. Although this is to some extent the case, the statement is calculated to mislead, since it is not in the body of the rock in which they occur, but in the hard breccia of a comparatively recent origin. The limestones near Shandon are very cavernous, and in many cases the roofs of ancient caves have fallen in and covered up their former floors. It is a breccia cleared from the fallen fragments of ribs which formed portions of an equal number of the skeleton, besides portions of the leg bones of the reindeer. These bones were met with at the depth of about 4 in. below the floor of a small cave imbedded in breccia about 2 ft. in thickness, and resting upon a mass of stalagmite about 16 in. in depth; beneath this stalagmite was another cave, which was, however, so blocked up with large masses of rock that an entrance could not be made into it. The investigation into the breccia, which was consolidated by the infiltration of carbonate of lime, was attended with great difficulties, the cave above it not being more than about 2 ft. in height, the hardness of the breccia was also very great, and consequently our labours were confined to an extremely limited area. Had it been otherwise many important results besides these we attained might have been arrived at, and the remains of animals now to the Pleistocene fauna of Ireland would probably have been discovered. Prof. Harkness was accompanied by Dr. Adams in these researches.

Mr. Robert Day, jun., M.R.I.A., exhibited and gave some account of an ancient Irish stone idol, which has lately passed into his collection. These grotesque figures are known to the peasantry as "Sheelanagigs." With this was exhibited a very small and perfect bronze celt, the sides of which projected above the top, and so formed a depressed upper edge. This is a peculiarity commonly met with in Italian objects of a like kind, but is of extremely rare occurrence in this country. It was found near Enniskillen.

Dr. R. Caulfield gave a description of the cargo of a Dutch pirate, commanded by Captain Claes Campane, who put into the harbour of Loimcon, in the west of this county, on December 10, 1624, with a view of submitting himself to the king's mercy. Clonakilty is stated to be twenty-four miles from Cork, and the fate of the vessel was that she went down in the bottom of Loimcon in three or four fathoms of water.

Mr. Hodder M. Westropp exhibited an Irish bronze ecclesiastical bell, and a portion of a bronze crozier, said to be of the twelfth century.

ARMAGH NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

On Thursday, the 7th inst., a lecture on "Sound" was delivered in the Society's House by Lewis G. Mills, LL.B., before a large and respectable assembly. The chair was occupied by the president, the Rev. Dr. Rutledge, Ex F.T.C.D.

The lecturer explained, in a popular style, the conditions required for the production of Sound, viz.: A sonorous body, the sound-wave, and the organ of hearing, the latter he illustrated by drawings executed by himself, and showing on a large scale the internal anatomy of the human ear. The velocity of sound, its intensity, pitch, reflection, refraction, and the interference of sound-waves were explained and illustrated; also the nature of overtones, resultant tones, beats, dissonance and harmony, &c.

On the motion of A. T. Osborne, Esq., seconded by J. L. Riggs, Esq., M.D., the thanks of the meeting were conveyed to Mr. Mills, by the chairman, who complimented him for his skill in treating the subject, and the scientific accuracy of his explanations.

GLASGOW PHILOSOPHICAL SOCIETY.

(Chemical Section.)

Ordinary Meeting, March 29th.—Mr. E. C. C. Stanford, F.C.S., vice-president, in the chair.

Mr. T. L. Patterson read two papers. The first was entitled—"On a Method for Obtaining a Continuous Current of Air or Gas under Pressure, for Blowpipe and other Purposes."—The author first explained how a continuous current of air or gas is obtained under ordinary circumstances by the mouth blowpipe or the foot-bellows, and then mentioned the chief objections to those two methods, and proceeded to describe a method which he had found to be free from those objections. He said that it was well adapted to blowpipe work, and that he could easily obtain a pressure equal to half an atmosphere by means of it. The principle involved is the same as the Catalan blowpipe of Sprengel, and is wrought in connection with a Bunsen filter-pump, although it may be erected separately. The air-tap of a Bunsen pump being opened, the water is turned off, and air passes with the water down a long pipe, of 30 to 35 ft., in a continuous stream of bubbles. By receiving the stream into a bottle or other vessel, made air-tight with a cork, through which two tubes are passed, one nearly to the bottom of the vessel, and the other just through the cork, the water will flow off by the deep tube, and air escape by the upper; and, by placing a stopcock on the upper tube, to regulate the escape of the air, the pressure in the vessel may be made equal to the height of the water-tube. The apparatus as used by Mr. Patterson is made of sheet-lead and "compo" pipes. A liquid may be boiled under the constant pressure of the apparatus by placing it in a strong flask, and connecting the latter (air-tight), by means of a flexible tube, with the pressure stopcock; or it may be distilled by connecting the receiver (made air-tight to the retort or distilling vessel) with the pressure stopcock, as before. It will also be found useful for increasing filtration, by applying the pressure on the surface of the liquid to be filtered, when it is not desirable to use, or convenient to obtain, suction from beneath. Probably the most useful application of this air-current is to the blowpipe. With a Herapath lamp it is easy, by means of the stopcocks, to obtain a small oxidising or reducing flame suitable for chemical experiments, or the strong and powerful jet for glass-blowing and crucible operations.

The author had not tried the apparatus with a Griffin's blast gas-burner; but, from calculations made, he had no doubt that, with a Herapath lamp, he could get a blast quite as strong as that obtained by using the Griffin lamp. He stated that it would be desirable to have a float-valve at the mouth of the airpipe, in the accumulator, to prevent the access of water into it, in the event of the apparatus at any time becoming deranged or over-taxed. In conclusion, the author explained how the apparatus might be used for delivering a steady current of any other gas not very soluble in water.

The cost of Mr. Patterson's apparatus, as fitted in connection with a Bunsen pump, is about 30s.

A discussion followed. Several members expressed themselves much interested in, and pleased with, the apparatus, as described by Mr. Patterson.

The other paper read by Mr. Patterson was "On an Explosive Balloon."—The author gave an account of some efforts which he made some years ago to fire explosive balloons on their ascent. At first he tried the india-rubber balloons of the toy-shops. From various causes they had failed; but the chief difficulty was doubtless the tension, which made it difficult to secure the gases. Recently, the author's attention had been directed to the collodion balloons, obtainable of the philosophical instrument makers, believing that they would suit well, both on account of their lightness, and on account of the fact that they would wholly disappear on ignition. After a number of trials he had found them to succeed admirably. The method adopted was as follows:—A fuse of filter-paper, about 1 in. long and ¼ in. broad is gummed to the side of the balloon, near the mouth, and allowed to dry. The latter is then filled with a mixture of 2½ volumes of hydrogen gas and 1 volume of oxygen, the mixture being prepared in a separate vessel. The mouth of the balloon is at once tied with a piece of thread, to increase the force of the explosion. When the balloon is ready to ascend, a drop of the so-called "Greek fire" (that is, a solution of phosphorus in carbon disulphide) is placed

upon the filter-paper; the thread is cut, and the balloon left to itself. In the course of half a minute or so the explosion ensues. It is necessary to have an excess of hydrogen in the mixture, because exosmose takes place so rapidly that by the time of ignition the volume of that gas is sensibly reduced.

The author mentioned that, in the course of his experiments with collodion balloons, he had found a very sensible amount of heat generated in the collodion film. This he believed to be due to the oxidation of hydrogen in the pores of the collodion, somewhat similar to the action of spongy platinum or platinum-black on a mixture of the two gases.

BOSTON (U. S.) SOCIETY OF NATURAL HISTORY.

MARCH 2ND.—Dr. C. T. Jackson, vice-president, in the chair. Thirty-nine persons present. The following papers were presented:—

"Description of the Larva and Chrysalis of *Papilio rutulus*, Boisd., of California," by Samuel H. Scudder.—By the kindness of Mr. Henry Edwards, of San Francisco, I have been favoured with two specimens of the chrysalis of *Papilio rutulus*, Boisd., of California, and with a coloured drawing of the full-grown caterpillar, made by Mr. R. H. Stretch; their resemblance to the early stages of our common *P. Turnus* gives them an additional interest to entomologists of the Eastern States, and I therefore publish the following descriptions from the material above mentioned.

Larva resembling perfectly in form and general appearance that of *P. Turnus*; the general tint of both head and body apple green, but the last two segments above, and the posterior third of the body at the sides, become gradually much paler; thoracic segments tinged above with purplish, the third segment with a dorso-lateral, transverse, double, circular spot, each portion formed of a minute yellow spot, encircled with black, also with a small, round, distant, subdorsal, yellowish spot; fourth segment with a small, square, dorso-lateral and a small, round, distant, subdorsal dark blue spot; the suture between the fourth and fifth segments is bordered rather broadly around half of the upper portion of the body with a bicoloured band, terminating squarely at the end, in front of the suture it is yellow, behind, blackish blue. The stigmata are marked with blue, and there is a subdorsal and lateral row of blue dots on the seventh to the tenth segments. Prolegs paler than the general hue of the body. Length, when contracted, 35·5 mill.

Chrysalis.—The two specimens referred to differ greatly in size and colour, the larger one having brownish-grey and blackish fuscous, the smaller apple-green and yellowish-brown markings. There is a rather broad stigmatal band, commencing at the tip of the abdomen, and continuing forward along the hinder edge of the wings to the eye, of a blackish fuscous or yellowish-brown colour; spiracles of the colour of the band, a very broad dorsal band of the same colour, but paler in tint, and especially so, anterior to the mesonotal tubercle, on the metanotum and the first abdominal segment, and quite obscured by pale on the terminal two or three segments; in the brighter specimen this band is edged faintly with white, space between these either dull white, clouded and streaked with yellowish fuscous or apple-green, the abdominal segments with a few short, longitudinal, delicate, black dashes; abdominal tubercles; wings either blackish fuscous, paler externally, the base of the veins streaked with black, and the tips of the nervules with a black dot, or apple-green, the base of the veins marked with pale dull yellowish edged with black, the base of the nervules marked delicately with black, and the wartlets at tip of nervules pale dull yellowish; whole front of abdomen either dirty white, more or less obscured and streaked with fuscous and blackish next wing tips, or whitish, slightly tinged or dotted occasionally with green or black. Legs, antennæ, and tongue blackish fuscous, or mingled green and yellowish-brown, streaked slightly with black; palpal prominences brownish fuscous, the sides paler, or green, above and within yellowish-brown; sides of pronotal tubercle wood brown, or yellowish-brown. Compared with *P. Turnus*, the lateral shoulder tubercles are slightly more prominent, the excision between the palpal prominences a little deeper, and the mesonotal tubercle very much larger; the subdorsal abdominal tubercles are also slightly more developed, and there is, in addition, a lateral row of minute tubercles. Length 27·5—36 mill. Height 7·5—9 mill. Length of mesonotal tubercle 2—2·75 mill.; distance of tips of palpal prominences apart, 4·5—5 mill.

"On the Phosphate Beds of South Carolina," by N. S. Shaler.—This paper, on the phosphate marls of the shore region of South Carolina, contained a partial account of the observations made upon this district by the author, while under the employ of the United States Coast Survey, and was published with the permission of the Superintendent of the Survey, Prof. Benjamin Pierce, of Cambridge. A portion of the conclusions have a certain commercial as well as scientific value, and it was deemed by the Superintendent desirable to place them before the public at the earliest opportunity. The remainder of the description of these beds will be found in the report of the work of the Coast Survey for 1870.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, APRIL 11TH.—The correspondence was presented by M. Elie de Beaumont.

There were several communications respecting an Aurora borealis which was seen in Paris, and over a great part of France, on Tuesday, April 5th.

There was also a communication from M. Duchemin on the destruction of carp by toads.

M. Dumeril made a verbal communication of details concerning the Axolotls acclimatized in the menagerie of the Natural History Museum, which have been observed for the purpose of deciding more exactly their curious and as yet but incompletely known metamorphoses.

M. Delaunay presented a note in the name of M. Camille Flammarion on a curious relation not hitherto pointed out which exists between the periods of rotation of the planets and their densities. Unlike the periods of revolution round the sun, which have the simple relations expressed by the laws of Kepler, the periods of rotation have up to the present received no explanation. The result of M. Flammarion's researches can be summed up in a remarkably simple law, which is that *the movement of rotation of the planets is an application of gravitation to their respective densities.* It is equal to the time of the revolution of a satellite supposed to revolve freely on the equator of the planet, multiplied by a co-efficient of retardation representing the density of the planetary body. This co-efficient of relative density is for every planet the square root of the ratio of gravity to the centrifugal force. Thus, for example, a satellite situated at the surface of the earth would revolve round it in the period of 1h. 24m. This number must be multiplied by 17 to give 24 hours. But 17 is the square root of the centrifugal force; if the earth revolved on its axis 17 times more rapidly than it does, bodies would no longer possess any weight at the equator. This co-efficient, 17, represents the density of the earth. For Jupiter the co-efficient is 3·6. The density of Jupiter, compared to that found for the earth, is also 3·6. For Saturn the co-efficient is 2·7. The density of Saturn is the same; and so on for the other planets. M. Flammarion has been able to calculate the periods of rotation of Uranus and Neptune, until now unknown. The calculation gives 10h. 40m. for Uranus, and 11h. for Neptune. By this discovery which may be considered to be the complement of the laws of Kepler and Newton, M. Flammarion established that no element of the system of the world is isolated, and that the forces which regulate the translations regulate also the rotations of the celestial bodies in space.

M. Duchartre read a note on the re-turning of mushrooms. Like the leaves of the phanerogamic plants facing the light, the supports of the fructification in these plants are normally directed downwards and return to this position by the formation of an angle in the stalk of the mushroom, when they have been turned away from their natural position.

Marshal Vaillant laid on the table the extract from Cuvier's baptismal certificate and the certificate of his marriage, in order to show that the name of Georges borne by the illustrious naturalist does not appear in these papers.

M. Dumas remarked that this fact was well known to those who had been on terms of intimacy with Cuvier's family. Georges was the Christian name of his father, and it was by the agreement of the members of his family that he took this name instead of his own.

M. Cahours presented a note by Professor Daniell containing the details of experiments made with the view of recognising the action that magnetism exercises on two currents passing simultaneously through rarefied gases. The experiments show that magnetism has no action on gases, but on the luminous current itself.

M. Laugier, in the name of M. Anthoine, presented a paper on the best forms for ships.

M. C. Robin presented a memoir on the origin of canals secreting bile, by M. Lebeau.

M. Bussy presented a paper by M. Bourgoing on the electrolysis of nitric acid.

M. C. Sainte-Claire Deville presented a paper by M. Testan on the metallic tartrates.

M. Bouillaud presented a paper by M. Bucquoy on diseases of the heart.

M. Guyon read a paper on a parasitic insect of equatorial regions—the chigoe—which has been also frequently observed in Algiers. The same author also read a note on some cases of madness observed by him in Algiers.

M. Liebreich then read a note on the operation for artificial pupil.

Lastly, M. Baillon read a paper on the dissemination of the grains of Dorstenia.

The Academy then formed itself into a secret committee.

SOCIÉTÉ PHILOMATHIQUE DE PARIS.

MARCH 26TH.—A note was received from M. Abel Transom on kinematics or phoronomy. It is to Ampère the first idea is usually attributed of a distinct science relating to *the laws of motion independent of the forces which produce it*; and it is therefore an act of justice to vindicate the priority as regards this idea of a *savant* less illustrious than Ampère, although not without fame, namely Hoëné Wronski. The author then proceeds to vindicate Wronski's claims. Sixteen years before the appearance of Ampère's *Essay on the Philosophy of the Sciences*, Wronski gave expression to this idea in his *Introduction to the Sphinx*.

THE VIENNA ACADEMY.

VIENNA, FEBRUARY 10TH.—Herr J. Rauter sent in a memoir on the development of certain forms of hairs in dicotyledonous plants.

Dr. Boué presented a first contribution of mineralogical and geognostic observations made during his travels in European Turkey. They have reference to North Albania, Bosnia, Herzegovina, and Turkish Croatia. In this contribution the extent of the Palæozoic, the Werfen beds, apparently also the Kössen group, the Dachstein limestone, the Trias, the Gosau formations, the Eocene Vienna sandstones, with serpentines, is rendered more evident, and the connection is shown of the Tertiary and Eocene basin of Western Upper Bosnia (Metaja and Sitnitza basin) with the North Albanian.

Prof. Redtenbacher made a verbal communication on some researches carried out in his laboratory by Herr Hanenschild on the hydraulic magnesian limestones of Austria.

Prof. Hlasiwetz made a preliminary communication on a new acid from grape-sugar. This acid is produced by the action of bromine on the sugar in the presence of water, and treatment of the product with silver oxide. It has the formula $C_6H_{12}O_7$. It is itself amorphous, but yields well-crystallized salts.

Dr. S. L. Schenk presented a memoir on the distribution of the gluten in the wheat-grain.

Prof. Lang presented a paper entitled "Crystallographic and Optical Determinations."

February 17th.—The president announced the death of Dr. Franz Unger.

Prof. E. Mach sent in a further communication on the observation of vibrations.

Dr. Sigmund Mayer made a verbal communication on intestinal movements, in which he described experiments carried out by himself and Dr. S. von Basch.

Dr. Boué concluded his account of the petrographic and geognostic observations made in his journeys in European Turkey, without touching on those which Herr Viquesnel made last year with himself and Professor Hochstetter. These observations are arranged in six contributions, the first, already communicated, on Bosnia, Herzegovina and North Albania, the second on Epirus and the west of Macedonia, the third on Upper Moesia and the east of Macedonia, the fourth on Bulgaria, the fifth on the east of Servia, and the sixth an explanatory commentary to Viquesnel's journal of travel.

NOTES AND MEMORANDA.

Australian Diamonds.—The work of mining for diamonds is going on quietly but steadily in the Mudgee district. It is stated that the Australian Diamond Mines Company have forwarded to England 984 stones in all. Other parties besides the two Melbourne companies are said to be doing well. Scott and party, just before the Christmas holidays, washed 12 loads, and obtained 110 diamonds, weighing 3½dwt., equal to 26 carats; nine of them weighed one carat each. They state their earnings to have been £12 a week. The statement of the correspondent of a Sydney journal as to the products of the Mudgee gold and diamond mines having been called in question by a local newspaper, a meeting was held on the 20th of December at Two-mile Flat, at which resolutions were passed confirming the statement made by the correspondent, and appointing a committee to collect statistics.

Files Sharpened by Galvanic Current.—A very interesting and economical process for re-sharpening files has been exhibited before the Société d'Encouragement of Paris by M. Werdermann. Well-worn files are first carefully cleaned by means of hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of 40 parts of sulphuric acid, 80 parts of nitric acid, and 1,000 parts of water. The negative pole is formed of a copper spiral surrounding the files, but not touching them; the coil terminates in a wire which rises towards the surface. This arrangement is the result of practical experience. When the files have been ten minutes in the bath they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner; but should the effect not be sufficient, they are replaced for the same period as before.

SCIENTIFIC DIARY.

WEDNESDAY, April 20th.

Royal Society of Literature, 4.30 p.m. Anniversary Meeting.
Meteorological Society, 7 p.m. "On the Temperature of Natal," by Dr. R. J. Mann.
Society of Arts, 8 p.m. "On a Practical Method of Meeting the Spelling Difficulty in Schools and in Life," by Alexander J. Ellis, Esq., F.R.S.
Glasgow Philosophical Society, 8 p.m. "On Houses for the Reclamation of Young Women," by Mr. William Walker.

THURSDAY, 21st.

Chemical Society, 8 p.m.
Linnean Society, 8 p.m. "On the Vertebrate Skeleton," by Mr. St. George Mivart, F.R.S.
Zoological Society, 4 p.m.
Numismatic Society, 7 p.m.
Harveian Society, 8 p.m. "Introductory Remarks on the Study of Children's Diseases," by Dr. W. H. Day.
London Institution, 7.30 p.m.
Leeds Philosophical and Literary Society, 7.30 p.m. "On the Modes of Sepulture employed by the Romans, Romanized Britons, and Anglo-Saxons, from the 4th to the 7th Centuries in England," by Prof. Rolleston, M.D., F.R.S.

FRIDAY, 22nd.

Quekett Club, 8 p.m. "On Ciliary Action in the Infusoria," by Mr. N. E. Green.
Clinical Society, 8.30 p.m.

SATURDAY, 23rd.

Royal Botanic Society, 3.45 p.m.

MONDAY, 25th.

Royal Geographical Society, 8.30 p.m.
Institute of Actuaries, 7 p.m.
Medical Society of London, 8 p.m.
London Institution, 4 p.m.
Philosophical Club, 6 p.m. Anniversary Meeting.
Torquay Natural History Society, noon. "On the Geology of Devonshire," by W. Pengelley, Esq., F.R.S.

TUESDAY, 26th.

Ethnological Society, 8 p.m. "On the Philosophy of Religion among the Lower Races of Mankind," by E. B. Tylor, Esq. "On the Brain in the Study of Ethnology," by Dr. Donovan.
Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m. Discussion "On the Maintenance and Renewal of Railway Rolling Stock."
Society of Antiquaries, 2 p.m. Anniversary Meeting.
Royal Institution, 3 p.m. "Moral Philosophy," by Professor Blackie.

WEDNESDAY, 27th.

London Institution, noon. Anniversary Meeting.
Society of Arts, 8 p.m. "A Narrative of the Works of the Suez Canal," by Daniel Adolphus Lange, Esq.

ZOOLOGICAL SOCIETY.—The secretary is thanked for his continued courtesy.

CONSTITUTION OF MAN.—"Dr. W. H."—We have received your note, but cannot make anything of it, except that it is unfitted for our columns.

FIRING UNDER WATER.—We are much obliged to "C. H. S." for the trouble he is taking.

STUDENT.—What you say is nearly correct. In the ordinary sodium phosphate the phosphoric acid is tribasic, although associated with only two atoms of sodium, the place of the third being filled by an atom of hydrogen. When mixed with silver nitrate the acid takes three atoms of silver, and as it has only two atoms of sodium to offer in return to the nitric acid, some acid remains free. The silver phosphate *is*, as you say, soluble in nitric acid, and some, but not all, of it does remain in solution in this case, so that you need no longer perplex yourself on that head.

AUSTRALIAN HIEROGLYPHS.—"R. T."—Thanks for your interesting communication. Please send us the block you refer to by pattern post.

WEDNESDAY, APRIL 27, 1870.

THE CONVEXITY OF WATER PAINFULLY DEMONSTRATED.

OUR readers will remember seeing in our columns some months since an advertisement to the effect that a Mr. John Hampden, of Swindon, offered the scientific world a wager of £500 that the surface of water was perfectly level. They may not, perhaps, be aware, however, that the wager was accepted; and that, too, by no less distinguished a man than Mr. Alfred R. Wallace, the well-known traveller and originator of the theory of Natural Selection. With, we suppose, either a sublime pity for ignorance or a supreme contempt for charlatanerie, Mr. Wallace staked £500 to demonstrate to Mr. Hampden that the surface of water is not level, but is less or more convex, according to circumstances. Doubtless it appears strange to those familiar with the rudiments of physical science and with the practice of engineering, that any one, presumed to be *compos mentis*, should have made such a proposition as that put forward by Mr. Hampden. Wonderful, however, as it may seem, it is not the less a fact, and those who have had the misfortune to receive from time to time Mr. Hampden's nonsensical lucubrations will not be in the least surprised at this.

The matter was arranged in this wise:—After a somewhat lengthy correspondence between the two principal parties, it was settled that Mr. Wallace should conduct a survey of the Bedford Canal, that each of the parties should have a referee, and that any difficulty which might arise between the referees should be submitted to an umpire, whose decision should be final. Under these circumstances, Mr. Wallace chose as referee —first, Mr. Walsh, the editor of the *Field*, and subsequently, owing to Mr. Walsh's compulsory return to town, a local medical man, Mr. Coulcher; and Mr. Hampden selected a Mr. Carpenter on his side. Ultimately, Mr. Walsh was selected as final arbitrator, and the subjoined document was engrossed and signed:—

"The undersigned, having each deposited the sum of £500 in Messrs. Coutts's bank, do hereby agree that if Mr. Alfred R. Wallace, on or before the 15th day of March, 1870, proves the convexity and curvature, to and fro, of the surface of any canal, river, or lake, by actual demonstration and measurement, to the satisfaction of Mr. John Henry Walsh, of 346, Strand, London, and Mr. William Carpenter, of 7, Carlton-terrace, Thornford-road, Lewisham-park, London (or, if they differ, to the satisfaction of the umpire they may appoint), the said Alfred R. Wallace is to receive the above-mentioned two sums, amounting to £1,000, by cheques drawn by Mr. John Henry Walsh to his the said Alfred R. Wallace's order; and if the said Alfred R. Wallace fails to show such actual proof of the convexity of any canal, river, or lake, the above-mentioned sums are to be paid in like manner to Mr. John Hampden. Provided always that if no decision can be arrived at, owing to the death of either of the parties, the wager is to be annulled; or if, owing to the weather being so bad as to prevent a man being distinctly seen by a good telescope at a distance of four miles, then a further period of one month is to be allowed for the experiment, or longer, as may be agreed upon by the referees.

"ALFRED R. WALLACE.

"February 8th, 1870." "JOHN HAMPDEN."

In accordance with these stipulations the survey was made on the 5th of March, and we need not say that Mr. Wallace was of course successful in demonstrating a distinct fall and rise in the water of the Bedford Canal between the two points selected.

As a natural consequence, Mr. Walsh handed over the two cheques for £500 each to Mr. Wallace, who is thus partly rewarded for the trouble he has taken in convincing, or trying to convince, Mr. Hampden of the utter absurdity of his ideas.

But now comes the reaction. We cannot say what were Mr. Hampden's ideas as to the probability of any sensible person accepting the wager, but we can well conceive that a person who takes up the peculiar line which Mr. Hampden represents, might imagine that in offering to stake £500 on the truth of his assertion, he was affording the world a strong proof of his opinion, with very little prospect of losing his money. Unhappily for him, Mr. Wallace is a gentleman who is not only desirous of convincing foolish men of their errors, but who is also most calm and temperate in his methods of argumentation, and who is not to be deterred from his purpose by any feeling that his high standing as a scientific man should prevent his coming in contact with persons of Mr. Hampden's eccentric way of thinking and writing. Hence those tears which metaphorically Mr. Hampden has shed in the pamphlet which we have just had the opportunity of reading,[1] and which, from the bitterness of feeling it displays, we can only attribute to the Swindon philosopher!

This *brochure*, written anonymously, is a species of abusive Jeremiad of the very lowest and most offensive type, and we can only say of it that, if it is not beneath the contempt of Mr. Wallace, it is a publication which that gentleman would do well to put into his lawyer's hands; for it is the most libellous and disgraceful tirade we have ever been pained by reading. Not only are Mr. Wallace and his referee assailed in language which is most ungentlemanly, but the umpire, Mr. Walsh, comes in for his share of the malignity which the writer of the pamphlet thinks it wise to employ. We do not care to lay before our readers many selections from this publication, but we cannot avoid giving a few extracts as a *raison d'être* for our comments. Speaking of Mr. Walsh, for instance, the pamphleteer says:—"Take these editorial functionaries away from their scissors and paste-pot, and they are found to be as great blockheads as other men—mere slaves to the popular taste, and most of them as venal as any hireling in existence. There is no doubt some moral or pecuniary pressure was brought to bear on the late decision, and, like all cowards, Mr. Walsh was afraid to uphold the truth, and the palpable evidence of the reports against the array of scientific opinion which he knew would be down upon him in the event of his giving judgment favourable to the anti-Newtonian theory." He speaks of Mr. Coulcher as a local "sawbones"; of scientific men as a class which, "next to horse-dealers and jockeys, bear the reputation of being the most tricky and unscrupulous in their assertions;" and generally he speaks of Mr. Wallace, by implication, as a liar, a cheat, and a swindler.

We can well comprehend how painful it must be to Mr. Hampden to have to pay £500 for indulging in the nonsense he has enjoyed so long, but this by no means justifies the course either he or his friends have taken in publishing this pamphlet; and we trust that Mr. Wallace, who has had the courage to put the cap and bells on Mr. Hampden's head, will equally apply the legal flagellum to the individual who has had the audacity and bad taste to write the pamphlet, and the cowardice to publish it anonymously.

A New Photographic Society has been formed, and another German journal started, by the photographers of Dresden. This, according to the *Photographic Journal*, is the second journal of the kind brought out in Germany during the last twelve months, and it is truly gratifying to find that the interest in photographic matters is by no means flagging, and that it is as keen as it ever has been. The president of the Dresden Society is M. Hermann Krone, who is likewise editor of the organ of the society, *Helios*; this is now the sixth photographic journal published in the German language, the others being the *Correspondenz* of Vienna, the *Mittheilungen* and *Licht* of Berlin, and the *Archiv* and *Notizen*. The two last-named journals are disconnected from any society, while the other four respectively represent societies in the cities where they are published.

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[1] *Is Water Level or Convex after all? The Bedford Canal Swindle Detected and Exposed.* The Controversy ended, as all such impious frauds must end, in victory for truth, and the defeat and disgrace of those who oppose it.—"Knowest thou not this of old, since man was placed upon the earth, that the triumphing of the wicked is short, and the joy of the hypocrite but for a moment?"—JOB xx. 4, 5. Swindon: Alfred Bull, Printer, Victoria-street. 1870.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

THE controversy between Dr. Tyndall and Dr. Bastian is one which the letters that have appeared on the two sides are far from bringing to a conclusion. It will be evident on reference to our leader on Dr. Tyndall's lecture that we think the position he takes up is one somewhat hastily arrived at, and by no means satisfactorily sustained. We do not go so far as to say that spontaneous generation is demonstrated; but we must confess that it appears to us that both Dr. Tyndall's and M. Pasteur's experiments are, as Dr. Bastian says, of a very ambiguous character. We are further of opinion that the problem is one, as Dr. Bastian thinks, to be wrought out by the biologist, and not by the physicist; and we think it somewhat unjust of Dr. Tyndall to ignore the fine memoirs of both English and foreign biologists, and to assert that the "very best modern work connected with this subject has been executed by a chemist." The question is one of the most difficult in the whole range of Science; and though we doubt that spontaneous generation, in Pouchet's sense of the term, will ever be demonstrated, we have reason to believe that Dr. Bastian's researches will go far to show that Pasteur's assertions are very far from the truth.

THE schooner yacht *Norna* is being fitted out for the purpose of dredging on the west coasts of Spain and Portugal. Her owner and master, Mr. Marshall Hall, will be accompanied by Mr. W. S. Kent, of the British Museum, and by Mr. E. Fielding.

DR. GOULD, the famous Transatlantic astronomer, has received an invitation from the Government of the Argentine Republic to visit that country for the purpose of establishing there a National Observatory, the proposed site for which is Cordova. If all plans prosper, this will be the second permanent national observatory upon the South-American continent. Dr. Gould is making strenuous efforts to reach Cordova by August 1st of the present year; he will take with him a Repsold meridian-circle of 54 lines aperture, an equatorial refractor, and some smaller instruments, with portions of the building.

ANOTHER asteroid was discovered by M. Borelli at the Marseilles Observatory, about a week ago. This makes the 110th on the list.

THE *New Zealand Examiner* hails the arrival of some English rooks by the *City of Auckland*, whose advent should now be gladly welcomed, labouring, as they do, under such a plague of wireworm and caterpillar. We trust that they will quickly multiply in the province, where they must infallibly prove a great blessing to agriculturists.

MR. R. H. ALLNATT, writing from Eastbourne, states that in the horizon, at the junction of the north with the west, nearly in the plain of the magnetic meridian, a bright Aurora borealis appeared on the evening of the 19th at 9.30, at an approximate elevation of 5°. It had no streamers, and was bounded below by a semi-spheroidal cloud of black cirro-cumulus, which cloud, at the disappearance of the Aurora, rose quickly above the horizon, and usurped the place of the lenticular light. During the passage of the huge chasms in the sun's photosphere, it was predicted that Auroras would be of unusual frequency; but, whatever may have been the disturbance of the correlative forces, solar and telluric, the electro-magnetic conditions appear to have been comparatively tranquil. The April of last year was much more frequently visited by auroral displays than has hitherto been the present month.

WE learn from the *Mail* that at Melbourne the 15th of February was the hottest day of the season. The thermometer reached 109° in the shade, and there was an overpowering hot wind blowing.

DIAMOND-MINING in Australia appears to succeed. The *Melbourne Argus* states that the mail steamer going this month will take with it 378 diamonds, weighing 87 carats, on account of the Australian Diamond Mining Company. The parcel is the produce of the last four weeks' work, and it is by far the best yield that the company has yet obtained. Better returns are expected as the mine becomes opened up. A parcel of small rubies go by the same mail. If found saleable in London, the company will be able to send larger quantities. The telegraph wire has not informed us of the finding of any diamonds at Mudgee during the month beyond those that have been obtained by the Australian Diamond Mining Company. It was stated, however, by the local paper, early in the month, that there had been a marked increase in the number obtained in the district. Better returns still would have been got but for the delay in the forwarding of machinery ordered two months previously, and which had only just arrived from Victoria. The people in the Mudgee district were very sanguine of the place turning out most successful. A parcel of diamonds from the Cudgegong River were received last week by Messrs. Clarke & Co., of Melbourne. The number of diamonds contained in the parcel was 164. These were in addition to the supply that has been received from the Australian company. The stones were quite up to the average for brilliancy and purity.

THE steam-tug *Fuh. L.E.*, intended for service in the Chinese rivers, and fitted with the Warsop aëro-steam-engine, has been heard of from Gibraltar, on her outward voyage; and her engines seem to have fulfilled, or even surpassed, all anticipation. Her captain writes "the aëro-steam system is invaluable to us," and then, going into details, he reports that he has carefully weighed his coal, and that he has had a consumption of only two and a half tons in 24 hours, working the vessel against a heavy lumping sea that has severely tried her capabilities. The engines of the *Fuh. L.E.* are of 60-horse-power nominal; and the consumption mentioned amounts to somewhat less than 4lb. of coal per nominal horse-power per hour; while 10lb. per hour is considered a moderate consumption with ordinary engines. The indicated or actual horse-power of the *Fuh. L.E.* amounts to about thrice the nominal, but the exact proportion varies with differences in the boiler pressure. As far as this pair of engines are concerned, it would seem that the saving by the aëro system is probably 60 per cent.—a result that becomes less incredible when we remember that according to those who have most carefully studied the subject, we do not obtain, in the common methods of generating and using steam, more than about one-eighth of the power which the fuel consumed is capable of yielding. The Warsop system may be said to depend upon the utilization of some of the force that would otherwise be wasted, and the whole of this force amounts to seven-eighths of that which is generated. Even if 60 per cent. of coal could be saved with certainty, there would still remain a margin for future improvements, so that the results obtained with the Warsop engine are fairly within the limits of what may be reasonably hoped for from work in this direction. In the face of some opposition, and after the full inquiry that is there always instituted, a patent for Mr. Warsop's invention has now been granted for the United States of America; and patents have also been taken out in the principal Continental countries. The system is, therefore, fairly launched, and its value for marine and for stationary engines has been brought to the test of independent experiment.

The question of the admission of ladies to the ordinary classes of the University of Edinburgh has at last been decided in the negative, after a somewhat stormy discussion. As things now are in our medical schools, we cannot but be satisfied with this result. On Tuesday week, at the half-yearly meeting of the general council of the University, Professor Masson moved that the women be admitted. Professor Laycock moved an amendment that they should not be admitted, and this was ultimately carried. We concur in great measure in the following remarks which fell on this occasion from Professor Laycock: — He said that Dr. Masson conceived that there would be no difficulty in women having instruction in any of the classes of medicine, and asked if they did not get instruction along with men when they went to church. But he (Dr. Laycock) would ask whether, when they went to church, they heard discussions on questions which excited the imagination they could not chasten, questions which professors, addressing men, were obliged to treat with great seriousness, and with great reticence. It was said that male and female students sat together in Paris class-rooms, and persons who had been present reported that they had seen nothing objectionable. It occurred to him to ask, What did they expect to see? The danger was not in the acts performed in the class-room, but in the thoughts that might be excited there. There could be no more important topic than the proper education of women; the great interests, nay, the very existence, of our civilization depended on their proper education; but this proposed medical education, if carried out, would be a curse to that civilization. These were strong words, but they were the result of long consideration and a very intimate knowledge of the subject. Should they educate women in medical knowledge which they could prosecute when they were basely inclined? The ladies now attending the University had come with the purest motives; but how were they to ascertain when a Magdalene came to their classes? Should they be allowed to inquire into the characters of any women presenting themselves? The question had often been asked, who were the women that would come to study medicine? How were they organized mentally, corporeally? That was a very scientific question; but it was a practical question. He had inquired into the conduct of a number of medical women in the United States and elsewhere, and, although there were a good many exceptions to the general rule, yet they had a tendency to become political and social economists rather than practical physicians, and in that capacity to discuss questions of morals which experienced male practitioners absolutely put aside. He repeated that they must look at the matter as involving deeply the question of public morals. Unless it was very guardedly considered, the University of Edinburgh might be giving currency to principles and doctrines of which it would have to be ashamed. With reference to the teaching of men and women in the same class, he himself would feel compelled in the presence of women to leave out a good deal of what he should otherwise say. One could say things to men separately, or to women separately, which one could not say to them when they were together. The ladies, no doubt, would be as pure as angels, but he could not say as much for the males. He knew from experience that some proportion of the students that came to the University had prurient thoughts, and were very apt to express them. Was he, then, to emasculate his lectures because five or six ladies were present in the class? Certainly not. On the score of justice to the students he would not deprive them of that information which he thought it was desirable to give them. On these grounds he would never think of admitting ladies to his class. With regard to clinical instruction, he, for one, would protest against having separate classes in the infirmary; and as for teaching men and women in mixed classes, what would the managers of that institution say—what would the public say? Professor Masson would say that some arrangement could be made. That was not teaching academically; it was a mere ladylike, sentimental style of instruction. The instruction given in a University should be solid, world-wide, truthful teaching, not a *dilettante* teaching such as Professor Masson referred to.

The valuable astronomical instruments from Hartwell-house Observatory, the property of Dr. Lee, deceased, were disposed of the other day at the rooms of Messrs. Christie, Manson, & Woods, in King-street, St. James's. The following were the more important objects:—Lot 1. The transit instrument, by Jones, of Charing-cross, 5-ft. focus and 3¾-in. aperture, mounted on stone piers, fitted with Brazilian pebbles, two setting circles, a full battery of eyepieces, and all necessary apparatus—11 guineas (Hodgson); 2. A sidereal clock, by Vulliamy, of Pall-mall, specially for Dr. Lee, furnished with mercurial pendulum and Graham's dead-beat—£25. 10s. (Page); 4. A Gregorian telescope, with 5-in. speculum and low stand—8 guineas (Harris); 5. An equatorial stand, universal, by Cooke, of York, for a 6-ft. refractor, with a cast-iron stand—14½ guineas (Gibson). Among other scientific apparatus were the following:—31. A 42-in. telescope, 2⅞-in. achromatic object-glass by Dollond, with brass pillar and claw stand, and mahogany tripod stand (fitted with divided altitude quadrant) to match; the telescope is fitted with finder, telescopic steadying rods, four Huyghenian eye-pieces, magnifying 40, 80, 130, 180 diameters, Kitchener's pancratic eye-tube, magnifying to 300 diameters, double gold-wire micrometer, &c., and all the accompaniments of a first-class telescope, contained in a handsome mahogany case—14½ guineas (Handford).

In connection with the great Comet of 1861, Mr. J. R. Hind writes to the *Times* to correct an oversight in a previous communication. He says:—In my communication inserted in your last impression, I have inadvertently referred to the great comet of 1861 as moving in an orbit resembling that in which the meteors of the April period appear to revolve, instead of the first comet of 1861, discovered by Mr. Thatcher, of New York, on the 4th of April. The following numbers will show the degree of similarity:—

	Meteors.	Comet, 1861 (I).
Perihelion distance.....	0·955	0·920
Eccentricity	0·9829	0·9835
Long. of perihelion.....	236°.....	243°
Ascending node	30	30
Inclination	89	80
Motion	Direct	Direct

Period about 415 years. The above comparison is given by Dr. Galle, of Breslau.

The Paris correspondent of the *British Medical Journal* points out that the agitation produced in the medical world of that city by the recent disturbances in M. Tardieu's class-room, and the consequent closure of the School of Medicine, is far from having subsided. The students appear to be divided in opinion as to the manner in which M. Tardieu should ultimately be dealt with. At a meeting, it was resolved by a twenty-fold majority that he should be requested to resign; while, on the other hand, a paper is being signed by those students who think that his resignation would be "un fait regrettable." A movement for the formation of a "Free School of Medicine"—that is, one independent of State patronage and control—has been originated. Two stormy meetings of students and professors have been held; but as yet no definite conclusion has been arrived at.

An event of some degree of importance, as bearing on the higher education, takes place to-day, when the examiners to the University of London are to be elected. These gentlemen are not required to be members of the University, nor even natives of England. In this provision, says the *Lancet*, the University of London shows a truly Catholic spirit. That the examiners will be men of distinction we may very confidently predict. There may possibly, however, be an undue preponderance of examiners from the same school, so as to lend some degree of support to charges of favouritism. Obviously, the

same medical school should not furnish both examiners in any branch of science. We observe that there is a vacant examinership in chemistry, and that the other examiner is Dr. Odling. Plainly, therefore, St. Bartholomew's should not supply the vacant chair.

It will be remembered that on the 13th of July last a deputation from the Council and India Committee of the Society of Arts waited on the Duke of Argyll, for the purpose of urging the Government of India to take steps for providing a Department of Agriculture for India. The Council of the Society have, therefore, great pleasure in announcing that a Department of Agriculture and Commerce for India has now been established, and that Mr. Rivett Carnac has been appointed the Secretary.

An attempt is being made to secure the admission into the Infant Orphan Asylum, at Wanstead, of one of the children of the late J. E. Sowerby, the well-known botanical artist and engraver. Mr. Sowerby rendered such excellent services to Science that we trust this attempt may be successful. Mr. Sowerby died a short time since, after a brief illness, leaving a widow and six children, with but scanty means of support beyond a small life insurance policy. Proxies may be sent to Mr. C. J. Sowerby, 54, Lombard-street.

A Bill lately passed by the Austrian Parliament for increasing the salaries of the University professors in the Empire has received the Imperial sanction.

Messrs. A. Liverside, of the Royal School of Mines, and H. N. Martin, of University College, London, have been elected to Scholarships for Natural Science at Christ's College, Cambridge.

Photographers generally will learn with regret the death of a distinguished exponent of their art, in M. Nièpce de St. Victor. He died suddenly, at his office in the Louvre, from apoplexy, at mid-day on the 7th inst., having been perfectly well in the morning. Regarding him as one of the most indefatigable and skilful of experimentalists, the *Photographic News* says, he has contributed largely to the progress of photography, and has, in various instances, been the originator of distinct branches of the art. He was unquestionably the practical originator of photography on glass plates, for although Sir John Herschel's experiments with glass plates coated with films of precipitated silver were prosecuted in 1839, it was not until the introduction of albumenized plates in 1848 that a practical process on glass came into use. One of the most interesting phases of photography with which M. Nièpce de St. Victor's name is associated is heliochromy, which, since the earlier labours of Becquerel, he has made almost entirely his own, some of his examples having been exhibited in the last international exhibition in Paris, affording an opportunity to the public of examining photographs in colour, a privilege which had before been only accessible to a favoured few. Amongst the processes out of the beaten path of photography with which M. Nièpce de St. Victor's name is associated, we may mention photo-engraving; experiments with salts of uranium as photographic agents; experiments with what he termed "stored-up light," and other new actions of light; photography without salts of silver, and various other processes in the by-paths of photography. M. Nièpce de St. Victor was, at the period of his death, seventy-two years of age.

Messrs. Lovell Reeve & Co. are about to issue an English edition of M. Baillon's great treatise, *L'Histoire des Plantes*. The first part is promised for October.

An error having been detected in the letter-press of the *Synopsis of the Extinct Batrachia and Reptilia of North America*, by Professor Edward D. Cope, it will be necessary to cancel and replace one of the forms. The author has therefore sent out a notice requesting those who have copies of Part I. to return them to him, 237, Dock-street, Philadelphia, U.S. The part will be returned corrected, and all postal expenses borne by the author.

The Silk Supply Association are very hopeful of succeeding in establishing the easy practicability of silk culture in this country and the colonies. It asks such of those gentlemen who are willing to assist it in its efforts as have mulberry-trees, to send small supplies of leaves occasionally to the secretary, at 65, Moorgate-street. According to our contemporary the *Gardeners' Chronicle*, the Science and Art Department of the South Kensington Museum has placed at the disposal of the Association a room for the purpose of rearing the silkworms during the ensuing months of May and June.

The large number of one hundred and sixty-two graduates received their diplomas last month at the Jefferson Medical College, Philadelphia. This is the first occasion of conferring diplomas since the opening of the college.

A new full chair has been created in the Medical Department of the University of Pennsylvania, to be entitled Professorship of Clinical and Operative Surgery, and Dr. D. Hayes Agnew, late Demonstrator of Anatomy, will be invited to fill it.

It is now, says a contemporary, ascertained that Dr. Munck, the Swedish naturalist, is one of the many victims of Lopez. He was detained in prison for some time, and then executed. His collections have been saved, and are on their way to Stockholm.

The following resolution was passed at a committee of the Council of the Royal Astronomical Society, held on the 8th of April:—"Resolved,—That the Fellows be informed that there is a possibility of the Government providing means of transit to and from stations on the Mediterranean for about sixty observers, who may be willing to take part in the observation of the total eclipse of December 22, 1870; and that persons *willing* to undertake a portion of the observation, on a plan to be arranged by the Council, be invited to send their names to the secretaries, and also to state the branch of observation which they would be prepared, or prefer, to undertake, and the instruments they would be willing to contribute." The names of those who are willing to take part in the observation of the eclipse should be sent in, if possible, before the next meeting of the Council of the Society, May 13.

The conversazione given on Saturday night at the Royal Society by the president, General Sir Edward Sabine, has, to some extent, redeemed the repute of soirées of this kind. Among the subjects of scientific interest the collection shown by Dr. Carpenter and the experiments by Mr. C. F. Varley were the most conspicuous. The greater portion of the room adjoining the entrance-saloon was taken up with illustrations of the animal life of the deep sea, including Echinodermata, Sponges, and Foraminifera. General Sabine seemed perfectly delighted with what Dr. Carpenter calls the beauties of the ocean. Some of the forms, when minutely examined, reveal structures of the finest delicacy imaginable. Inglefield's hydrostatic steering apparatus was remarkable on account of the power which it evidently gave to the man at the helm. Several other instruments and models of engineering interest were shown. The dark-room was occupied by Mr. Cromwell F. Varley, the electrician, whose experiments drew considerable attention. Gassiot, Grove, Tyndall, and the Earl of Caithness were unanimous in their approbation of Mr. Varley's efforts and success. He exhibited some striking phenomena in a Geissler's tube, which reminded one of the *streamers* and *formation* of the Aurora borealis. An exhausted tube was placed over the poles of a powerful electro-magnet and a current of electricity sent through. The inside of the tube presented the usual brilliant violet glow around the negative pole, and a diffused feeble light throughout the tube, until the magnet was excited. Then the diffusion disappeared and a luminous arch was formed joining the two poles of the magnet, and extending even beyond the negative-pole. Gassiot and Plücker's re-

searches on the same subject have some years ago shown that there exists a connection between magnetism and the discharge in vacuo. Mr. Varley's experiments on Saturday went to show that the luminous arch is hollow, and that it can be intercepted by a solid substance. He argues that incandescent matter is projected from the negative-pole, but controlled as to its course by the magnetic rays.

THE following is a *résumé* of the courses of lectures on Physical and Natural Science about to be delivered at Oxford:—The Savilian Professor of Geometry (Mr. H. Smith) will lecture on "Geometry of Three Dimensions" on Wednesdays and Saturdays, at nine a.m., commencing April 30. The Professor will also lecture informally on Tuesdays and Fridays, at eleven. The Sedleian Professor of Natural Philosophy (Mr. Price) will lecture on "Elasticity and Problems in Applied Mathematics" on Tuesdays and Thursdays, at one, commencing April 28. The Professor of Experimental Philosophy (Mr. Clifton) will give practical instruction in the methods of weighing and measuring. The Professor of Geology (Mr. Phillips) will lecture on the "Fossils in the University Museum" on Mondays and Wednesdays, at twelve, commencing Monday, May 2. The Professor will also be happy to meet students informally in the Museum on Tuesdays and Thursdays, at twelve. The Professor of Mineralogy (Mr. Story-Maskelyne) will lecture on minerals of various classes on Tuesdays and Fridays, at half-past seven p.m., commencing Friday, April 29. The Professor of Chemistry (Sir B. Brodie) will see students on Saturday, April 30, from eleven to twelve. The Demonstrator in Chemistry (Mr. Wyndham) will lecture on the "Methods of Volumetric Analysis," in connection with a practical class, on Mondays, Wednesdays, and Fridays, at eleven, commencing Monday, May 2. Practical instruction will also be given. The Linacre Professor of Anatomy and Physiology (Dr. Rolleston) will lecture on "The Nervous System" and on "Classification." The lectures on the Nervous System will be given on Saturdays, at one; those on Classification on days to be hereafter fixed. The course begins on Saturday, April 30. The Professor of Botany and Rural Economy (Mr. Lawson) will lecture on "Structural Botany" on Mondays, Wednesdays, and Fridays, at one, commencing Wednesday, April 27. He will also lecture on the Principles of Classification and Economic Botany on Tuesdays and Thursdays, at one, commencing Thursday, April 28. The Professor of Zoology (Mr. Westwood) will be happy to see students who may desire to work at the invertebrated classes. He will also, in conjunction with the Professor of Botany, make afternoon excursions during the term.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

NOTES ON THE NOMENCLATURE OF INGENITE (INTRUSIVE) ROCKS.

BY G. H. KINAHAN, M.R.I.A., ETC.

IN a recent number of the *Geological Magazine* (vol. vii. p. 103), Mr. G. Poulett Scrope called attention to a most important subject to the geologist, namely, the varying mineral and chemical division of rocks attempted to be forced into the science of geology by some of the geologists of the present day. Mineralogists may adopt these divisions if they think proper, but geologists cannot, if they intend their science to remain pure; as their science is the study of rock petrologically or in rock masses, and not lithologically or by their varying mineralogical composition. To simplify the study of ingenite rocks ought apparently to be the aim of every geologist. This, however, can never be accomplished if a false classification is adopted.

Another innovation that seems now to be in fashion is the invention of new names, or the adoption of names that have no special merit to recommend them, thereby, instead of simplifying the science, making confusion doubly confused. Mr. David Forbes some time since, in the *Geological Magazine* (vol. iv. p. 49), pointed out the barbarous uses to which geological names may be put, and perhaps I may be allowed to call attention to two names lately attempted to be introduced into the nomenclature, more especially as in addition to their want of merit they are pernicious. Among the ancient ingenite rocks, intermediate between the "greenstones," or basic-rocks, and the "felstones," or acid-rocks, is a class partaking more or less of the nature of both, and having very similar relations to them as those that the "greystones" of Scrope have to the Trackytes and Dolorytes among the modern or volcanic ingenite rocks; for these rocks the term Porphyrite is to be adopted. Many geologists believe the names Porphyry and Porphyrite to be synonymous; this, however, is not to be the case, but the latter is to be confined to "quartzless rocks," "usually of a dark colour, having a felsitic matrix containing individual crystals of felspar, mica, or hornblende." Cotta, who seems to be the first to propose this name for these rocks, thus recommends (?) it. "The name of porphyrite refers to a texture *which is not an essential feature of these rocks, and the porphyrites are not always in fact porphyritic.*" Thus we find that a name which has a special reference to the porphyritic character of rocks is to be applied to a class of rocks that often have not this character. Moreover, these rocks as a class are not quartzless, for although those belonging to the newer Palæozoic epoch may in general be quartzless, yet the older Palæozoic basic-felspathic rocks nearly always contain more or less quartz. It may be said that this class of rocks wants a name. If they do, why not use the term Eurite, specially invented for and given to them half a century ago by D'Aubuisson on account of their fusibility? The other objectionable name is *Mica-trap*. Cotta's definition for this class of rocks is "compounds of mica and felspar without marked porphyritic texture. They contain no quartz unless quite exceptionally." This definition is that of the rock called *Minnette*, and why change the latter name for one that is objectionable? as *Trap*, according to the Swedish geologists, from whom we received the name, is a variety of doloryte, a compact blackish-coloured rock, composed of felspar and pyroxene. Some British geologists use the name mica-trap while describing varieties of dioryte and doloryte, and although in the latter case lithologically they may be correct, yet petrologically they are not, as the rocks so called are portions of dylas or masses of doloryte that in these places are more or less micaceous, consequently not correctly a petrological or geological division, but rather a lithological or a varying mineral and chemical division for a portion or portions of rock-masses.

THE SULPHUR-BEDS OF CALIFORNIA.

THE production of sulphur and manufacture of its compounds in California are rising in importance. The chief supply of the world is obtained from the sides of Mount Etna, in Sicily, and that State used the Sicilian brimstone until lately. Now the sulphur-works on the shore of Clear Lake produce four tons a day, as much as the coast can consume. The freight from the Mediterranean, the increased charge on account of the combustible nature of the material, and the necessity of keeping large stocks on hand, so as to prevent any disturbance of trade in case a cargo should be delayed or lost, give decided advantages to the home manufacture.

The Sicilian brimstone cannot be had in California for less than four cents per pound, and the domestic article is sold for three and a half cents. Clear Lake occupies the crater of an extinct volcano, and the evidences of volcanic action are

abundant in the vicinity. The triangle formed by the lake, the Geysers, and St. Helena—each about twenty-five miles from the other two—abounds with volcanic scoria, trap, lava, obsidian, tufa, warm springs, and other remains of eruptions, and signs of subterranean heat at no great distance from the surface.

The sulphur-bed of Clear Lake is about eight miles from the southern end, on the eastern shore, only a few hundred yards from the water. There is a bank resembling ashes, in which there are numerous alkaline and sulphur springs, and, also, vent holes from which sulphurous fumes escape. These holes are surrounded by beautiful crystals of pure sulphur deposited from the fumes rising from below. The earth, containing about fifty per cent. of sulphur, is placed in an iron retort, which is heated to a high temperature, so that the sulphur is driven off in fumes into a receiver, where it settles in a liquid form, and runs out into pine boxes, 2 ft. long and 1 ft. square. It is as pure as the Sicilian brimstone; but the latter comes in sticks, which are more convenient for handling, when small pieces are wanted.

The lump sulphur is used chiefly for making powder and sulphuric acid, which last is employed in making blue-stone, giant powder, nitric acid, and muriatic acid, and in refining gold and silver. The consumption of sulphuric, nitric, and muriatic acid on the coast amounts to 2,000,000 lb., and the entire demand is supplied by home manufacture.

Lately the production of flowers of sulphur has been commenced at Clear lake. The fumes passing off from the retort, instead of being carried into a small hot receiver as for brimstone, are led into a large cool chamber, in which they condense into a flaky, snowlike condition. This form of sulphur will be needed in large quantities next spring and summer, as a cure for the mildew which attacks the vines, and did great damage in many of the vineyards last year.—*Alta, California.*

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From April 17th to 23rd, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
2 Mouflons (Ovis musimon)	.....	Born in the Menagerie	Sheep-sheds
1 Bengalese Leopard Cat (Felis Bengalensis)	India.....	On approval.....	Carnivora-dens
2 Brazilian Caracaras (Polyborus Brasiliensis)	Buenos Ayres	Presented by G. Wilks, Esq., C.M.Z.S. ..	Falcons' Aviary
1 Chimanango (Milvago chimango)	Ditto.....	Ditto.....	Winter Aviary
1 Chilian Sea Eagle (Geranoaëtus aguia)	Ditto.....	Ditto.....	Vultures' Aviary
1 Rose-crested Cockatoo (Cacatua Moluccensis)	Moluccas	Presented by Dr. R. S. Peart.....	Parrot-house
1 Indian Python (Python molurus)	India.....	Presented by Mr. E. Chimpson	Reptile-house
1 Guatemalan Amazon (Chrysotis Guatemala)	Central America ...	Purchased.....	Parrot-house
1 Angulated Tortoise (Testudo angulata).....	Africa	Ditto.....	Ditto
1 Stanley Crane (Tetrapteryx paradiseus)	South Africa	Deposited by E. O. Blake, Esq.....	Eastern Aviary
2 Secretary Vultures (Serpentarius reptilivorus).....	Ditto.....	Ditto.....	Ditto
1 Cretan Goat (Capra beden) ♂	.....	Born in the Menagerie	Goat-sheds

♂ Male. ♀ Female.

ANIMALS AS FELLOW-BOARDERS.

BY P. J. VAN BENEDEN.

IN THREE PARTS.—PART I.

A PAPER by M. P. J. van Beneden was recently read before the Belgian Academy, on what he termed the *commensalisme*, commensiolity, or literally, *commontableisme* of animals, describing the habits of creatures who may be said to board together, but whose association is distinct from that of victim and parasite.

Every fish, he says, is a living and moving territory, on which a fauna is developed possessing special interest. When a small animal claims to profit by the fins of one larger than itself, accompanies it in its chase, and picks up spoils which the larger one disdains or abandons, we see none of the motives which characterize parasitism. Even when one resides upon the other, it frequently does not deserve the term which is applied to it. It is not rare to find loyal companions by the side of generous hosts, rendering service in return for the hospitality they receive. The parasite makes it his business to live at the expense of another; the associate is simply a table companion. When a whale is covered with barnacles, who can say that these Cirripeds are parasites? They merely ask of their colossal companion a lodging-place, and they are not more dependent upon him than coach travellers or railway passengers: they feed themselves on their journey. Leeches behave quite differently: temporarily attached to the skin of their host, they suck his blood, and drop off after their meal, that they may conveniently digest it. They are not deemed parasites, because they leave their host during the intervals between their meals; but this is an erroneous opinion; for they are true parasites, as the barnacles are true companions.

There are many animals living in common whose relation to each other is not well appreciated, and it will not be uninteresting to glance at these, and endeavour to form a notion of the ties that unite them. We do not mean to speak of those associations which are known as flocks and troops, composed of individuals of the same species united for defence or attack; or of different sexes, neuters, workers, soldiers, &c., which belong to the same family. Our purpose is with associations of different species whose members bring together their energy, their intelligence—I might say, their capital, and become fellow-boarders, living on terms of perfect equality; although it is not uncommon to see the strong use up the weak, or the evil-disposed slip in amongst peaceful communities. The sea-bed has its bravoes and *fiers-a-bras*.

Amongst fellow-boarders we see some that preserve all their independence, and who, at the least cause of discontent, break the connection, and seek their fortunes elsewhere. They are recognized by their apparatus for fishing and travelling, which they never put aside. Others install themselves upon their neighbours, throw away all their travelling gear, make themselves comfortable by a change of toilet, and renounce for ever their independent life. Their lot is fixed to the creature that carries them. They are permanent fellow-boarders.

Let us consider, first, free fellow-boarders. We find free fellow-boarders in different classes of the animal kingdom. Sometimes they sit on the back of a neighbour; sometimes they go in at his mouth, and follow the route of his food; and sometimes they take refuge under his cloak. An interesting instance belonging to this first category is afforded by the graceful fish, the Donzella, which makes its abode in the body

of a Holothuria.[1] The Donzella is elongated like an eel, and so compressed that it has been compared to a sword. It is found in different seas with precisely the same habits. The fish lodges in the digestive cavity of its companion, and, without regard for the hospitality it receives, takes its share of everything that enters. It makes use of a generous acquaintance, who can collect food better than itself. The Holothuriæ, or sea-cucumbers, are excellent fishers, and we often find in them, side by side with the Donzella, who are probably gluttons, prawns and pea-crabs, who come for their part of the spoil. My friend C. Semper has seen sea-cucumbers in the Philippines who were not bad imitations of an hotel furnished with a *table d'hôte*.

In the Indian seas a fish is found known as *Oxibeles lombricoides*, modestly lodged under a star-fish (*Asterias discoides*), and taking advantage of its fishing powers. In Brazil, a Siluroid, of the genus Platystoma, a clever fisherman, thanks to his numerous lines, lodges very small fish, which were for a long time supposed to be its young. It was thought the female kept her young in her mouth, as the marsupials keep their infants in a pouch; but it is now known that they are adults and completely developed, but instead of living by their own labours, they prefer to lodge in the mouth of a good-natured neighbour, and take tithe of the food that comes in. This little fish has received the name of *Stegophilus insidius*. We see that in the animal kingdom it is not always the big which make use of the little.

Dr. Bleeker, an able naturalist who has rendered good service to science, makes us acquainted with an association of a still more remarkable character—that of a Crustacean who makes use of a fish,—the black *Stromatée* of the Indian seas lodges in in its mouth a *Cymothoa*, who, if not well adapted for catching his prey in a free state, is perfectly organized for swallowing what comes to him in this position. In the China seas Dr. Collingwood found an anemone not less than two feet in diameter, in whose interior lively little fish resided, the name of which he did not know; and, without quitting our shores, we may observe an elegant jelly-fish (*Chrysaora isocela* ?) sheltering many young scad (*Caranx trachurus*), which surprise us by swimming out from the body of their host.

It is, however, amongst the Crustaceans that we shall find the most remarkable examples of free fellow-boarders. The Crustaceans comprise lobsters, crabs, cray-fish, and legions of small animals who act as the sanitary police of the shores, and purify their waters of organic matters that would otherwise corrupt them. They are not like the insects, variegated and glittering in colour; but their forms are robust and diverse, and they often please by some special attraction. Among these Crustacean free-boarders one of the most interesting, though one of the least, is that tiny crab, the pea-crab, which lives in mussel-shells, and has been wrongfully accused of injuring the quality of their hosts as food. They have been very numerous this year, but cases of mussel-poisoning have not been more common than usual, and when such effects occur, it is the mussels themselves that are to blame. They produce a bad effect on some persons by idiosyncracy—we know the word though we do not know the thing.[2] For what reason do these small crabs, the Picnotheras of naturalists, which are not found elsewhere, inhabit these bivalve mollusks? The ancients, who knew the pea-crab of Pinna, thought that the mollusks having no eyes were glad to avail themselves of the good sight of the crabs. These, like other Crustaceans of the same rank, carry on each side of the carapace, at the end of a movable support, a charming little globe, furnished with hundreds of eyes, which they can direct, as an astronomer turns his telescope, to any part of the firmament. What cannot be doubted is, that the little intruders live on good terms with the mussels, and if the latter supply a convenient and safe lodging, they on their side profit largely by the morsels which fall from the claws of their guests, who are well placed and well provided with prey-catching apparatus. Snugly seated in their living house at the bottom of the sea, they possess a movable lair which the mussel carries about, and they can choose the best moment for attack, and fall upon the enemy unawares.

Pea-crabs are found in all seas, and in a great number of bivalve mollusks; the North Sea even containing a large sort of mussel, *Modiola papuana*, found in deep and difficultly-accessible spots, which always contains a couple of pea-crabs as large as a hazel-nut. The great Avicula (*Avicula margaritifera*) which furnishes the oriental pearls, also lodges pea-crabs of a particular species, and it is not impossible that these creatures, and similar fellow-boarders, contribute to the formation of the gems, since these objects, so highly prized for feminine decoration, are only the results of vitiated secretions, most often produced by wounds. We have opened hundreds of these Aviculæ, and have never found them destitute of their crabs, many of which we placed long ago in the Museum of Natural History in Paris.

We also find pea-crabs in the great clams *Tridacna gigas*, whose shells might serve for a *bénitier* in the churches, and no doubt they would be discovered in many bivalves not yet considered.

On the coast of Peru there is a little crab which lives under rather different conditions. He chooses not a bivalve mollusk, but a sea-urchin, lodging in its anus, ready to seize any creature who may be attracted by the excreta. There is likewise a small crab, *Hopalocarcinus marsupialis*, which dwells amongst the depths of the thick branches of a coral found in the Sandwich Islands, and is at last completely inclosed in the dividing stems.

An association of a different kind, and the nature of which is difficult to appreciate, is that of a little crab, the turtle crab of Brown, found in the open sea on the carapace of sea-turtles, and sometimes on sea-weed (*fucus*). The sight of this crab is said to have given confidence to Columbus eighteen days before his discovery of the new world.—*The Student*.

[1] In a note, M. van Beneden says naturalists have long known these fishes as Pierasfers. They are allied to (*voisins*) Ophidium, eel-pout or barbolt, and sand-eel—fishes which are very dissimilar. It is the sand-eel particularly the Donsella is said to be like.—Ed.

[2] Particular mussels often produce poisonous effects on persons with whom this species of food usually agrees. This probably arises from a particular state of the mollusk rather than of the person they injure.—Ed.

A GEOLOGICAL DREAM ON SKIDDAW.

BY J. CLIFTON WARD, F.G.S.

IN THREE PARTS.—PART III.

FOR a vast period did this ocean prevail, and then for as vast a period unsettled movements, during which nearly the whole of England was brought above water, and much previously-deposited matter swept away, while life itself underwent a slow, though complete, change.[1]

Finally, the south-east of England alone became sea.[2] The climate seemed warm, or sub-tropical, and currents bore into this ocean Gulf fruits and fragments of trees from some not far-distant spice islands.[3] Monkeys and other mammals inhabited the land, crocodiles dwelt in the creeks, turtles crept along the sea-shore, serpents lurked in the forests, and sharks innumerable thronged the sea.

Once more, however, a cold period returned,[4] which was succeeded by another warm and genial age, when, at first, a long island, or continental isthmus, separated a northern from a southern gulf, while afterwards nearly all but the southern edge of England was above water,[5] that part being occupied by estuaries with scattered islands. Now flourished forests of oak, elm,

[1] Interval between the end of the Secondary and commencement of the Tertiary.
[2] Lower Eocene period.
[3] Fossil fruits of the Isle of Sheppy.
[4] Middle Eocene.
[5] Upper Eocene period.

beech, firs, and pines, among which wandered curious and antique mammals, some uniting the characters of the rhinoceros and the horse,[6] some more like the modern tapirs,[7] and various other forms, while tiger-like carnivores[8] roamed the forests for their prey.

So, I saw in my dream that centuries after centuries rolled on, England became wholly dry land,[9] old life died out and new appeared, an early form of elephant,[10] and the deer tribe, with a three-toed horse,[11] and others, taking the place of the former inhabitants, and forming links between them and those to come. But cold again set in,[12] and drove many of them farther south into warmer climes.

A long period elapsed, the eastern parts of Norfolk and Suffolk sank beneath the sea;[13] warmth once more returned; the elephant and rhinoceros, tapir and horse, ranged the country; tigers and bears roamed over the land, and hippopotami waded in the rivers.

Long did this condition of things last, during which time, and for the long ages preceding, in which the greater part of England had been above water, the atmosphere was working steadily yet surely in wearing down the solid land. Rain, snow, and ice all helped in turn. Streams and rivers carried away the loosened material and deposited it in the sea. The waves swept off what the atmosphere detached from the cliffs above. Valleys of great width and size were slowly carved out. Here, hard rocks resisted the weathering influence to a great degree; and there soft materials were with ease removed, and wide-spread plains formed. In one part, rugged and mountainous scenery was elaborated; in another, smooth and undulating.

But yet again the climate changes, and snow-capped mountains and ice-covered country succeed to genial warmth.[14] Many of the inhabitants of land and ocean retreat southwards; others, such as the elephant and the rhinoceros, become adapted to the cold by assuming woolly coats. Over the frozen plains which these inhabit range large oxen, bisons, and reindeer, while cave-bears and hyenas leave their dismal haunts to roam in search of food.

Now, however, a change comes over the country of a nature not seen for many an age. Slowly and quietly the whole land sinks down beneath the ocean, excepting quite the southern part, and the higher points of the present Wales and Cumberland. In these last spots occur groups of islands,[15] each a little nursery of icebergs.

As the land once more rose to nearly its former level, the glaciers again for a time filled the valleys, deepened and scooped them out, wore down, smoothed, and scratched the solid rocks over which they flowed, and still further polished the country. The animals which had retreated southwards on the sinking of the land now gradually return, and with them, traversing the plain connecting England with the Continent, comes man, rude in the arts, using flint implements, living on the produce of the chase, and maintaining an active warfare with the beasts of the land.

Smaller and smaller grow the glaciers of Wales and Cumberland, and many a hollow, occupied and formed by them, becomes the nestling-place of some smooth and mountain-reflecting lake. The never-ceasing action of atmosphere and sea, aided by a slight depression of land, next severs England from the neighbouring continent, and man, though savage first, and as untamed as the wild beasts he hunts, becomes slowly civilized by contact with more advanced races, who seek out this island home, and who absorb or drive away the weak and savage aborigines; in this way, rude stone implements give way to those of metal; cave dwellings to rudely-built huts; and agriculture is introduced among those who hitherto, had lived solely by the chase.

As time wore on, I seemed to watch the gradual development of man's mental capacities; but long ere his present state was reached, I, long time enchanted by the sight of changes so many and so vast, awoke, and starting, found myself, with evening shadows falling, still on Mount Skiddaw. Thence I hastened, my mind all eager to see if these things were so; and soon I saw rocks formed of ancient mud containing mummies of lowly organisms,[16] beds of ancient lava and ash,[17] roots of old volcanoes;[18] numerous wide and deep valleys, the result of ages of atmospheric wear and tear; hollows now filled by lakes;[19] and rocks, smoothed, polished, rounded, and scratched, as ice alone can do.[20] And, as I thought on these things, Chaucer's wise saying came to my mind—

> "Many men sain that in sweveninges[21]
> There n'is but fables and lesinges;[22]
> But menne may some sweven seene
> Which hardely[23] that false ne bene.

—*Pamphlet, published by Trübner & Co.*

[6] Palæotherium, Anoplotherium.
[7] Lophiodon.
[8] Hyænodon.
[9] Miocene period.
[10] Mastodon.
[11] Hippotherium.
[12] Upper Miocene.
[13] Pleiocene period.
[14] Pleistocene.
[15] Thus Skiddaw and Saddleback, in Cumberland, probably were islands separated from the main mass farther south by a sea-strait, now Keswick Vale.
[16] Skiddaw slates, containing graptolites.
[17] The so-called "Green Slates and Porphyries," around Borrowdale, Thirlmere, &c.
[18] Greenstone of Castle Head and dykes.
[19] Many, if not all, of the existing lakes of Cumberland are "rock-basins," though the old sites of many moraine-dammed lakes may easily be traced, the lakes having been drained by the cutting through of the moraines.
[20] The rocks of Borrowdale, St. John's Valley, &c.
[21] Dreams. [22] Lyings. [23] Certainly.

A NOTICE OF RECENT OBSERVATIONS ON AMŒBÆ AND MONADS BY RICHARD GREEF AND L. CIENKOWSKI.

BY HENRY E. FRIPP, M.D.

IN THREE PARTS.—PART II.

ON the question of the casual connection between life and organization introduced by Huxley in his prefatory remarks, I shall, if time admit, say a few words after we have become acquainted with the new species of land Amœbæ described by Dr. Greef. Suffice it here to say that, without straining the terms of Huxley's own definition of Amœbæ, organizations of a very definite kind may be claimed for animals which possess a nucleus and contractile vesicle, and present an approach to a sexual mode of reproduction, besides multiplication by division of substance.

In his Hunterian Lectures (1868), Huxley specially mentions the nucleus and contractile vesicle of Amœbæ, their multiplication by fissure, and by a low form of sexual reproduction. The Amœboid stage of the Gregarinida, ending in an encysted condition, in which reproduction by pseudonaviculæ, is also maintained by Huxley. The observations of Greef considerably augment our knowledge of structural changes, and of the mode of reproduction of the Amœbæ, and tend, as I think, to modify the broad assertion that these animals have no organization in the strict sense of the word.

To Dr. Greef's account I shall now direct your attention.

And first, in respect to their habitat and mode of life. Dr. Greef finds these animals very commonly present in sand, and at the root-fibres of mosses, grasses, and other plants which grow in shallow mass upon stones, rocks, walls, house-roofs, trees, &c., that is, upon a firm bottom. They appear, therefore, in exactly the same places as the Arctiscoidæ, wheel-animalcules, anguillulinæ, &c., *e. g.*, in the sand under thin liverworts and lichens, and are found generally in company with these,—may therefore be sought for wherever these creatures are found. Dr. Greef, however, has often searched for them in vain where the above-mentioned animals exist in abundance, while at other times a numerous population of Amœbæ is to be seen under every moss examined. The conditions favourable

to their presence Dr. Greef has not been able to determine with accuracy, but considers that a position exposed to the sun, and the greater or less abundance in the earth of small Diatomaceæ and other Algæ, which naturally constitute their chief aliment, must materially influence their presence. As to their condition of life, these Amœbæ, living generally in company with Arctiscoidæ, must share in common with them the power of withstanding a high degree of dryness for a long time. The nature of their habitat renders it certain that a rapid drying-up of the earth or sand, especially in summer, must often occur, during which the active life of the Amœbæ is interrupted—that is to say, the creatures become torpid, just as the Arctiscoidæ do, a fact which Dr. Greef has shown in an essay on these latter animals (2nd vol. of Schultze's *Archiv*). Their power of retaining life is indeed wonderful. The outer tough coriaceous but transparent layer draws together as the surrounding medium becomes drier, and thus protects the inner softer granular parenchyme from drying up. In this perfectly motionless and apparently lifeless state, the creatures are met with in dry sand, from the particles of which they are scarcely to be distinguished. But by moistening the sand in which they may have dried up thus for months, they regain quickly an active existence.

The following species are described by Dr. Greef:—

Amœba terricola. The adult animal measures 0·35 to 0·4 mm. in greatest diameter=$\frac{1}{71}$ to $\frac{1}{63}$ English inch.

A. brevipes=$\frac{1}{620}$ to $\frac{1}{600}$ inch in size.

A. granifera=$\frac{1}{600}$ inch.

These two species are probably only young specimens in early stages of development.

Amœba gracilis. Wormlike in form, about $\frac{1}{300}$ inch long.

A. Amphizonella. Dr. Greef considers this creature to be rather a new genus altogether, of which he describes the following species, viz.:—

Amphizonella violacea. Measuring about $\frac{1}{300}$ inch.

A. digitata. $\frac{1}{300}$ inch.

A. flava. $\frac{1}{600}$ inch—adult size.

These species will be characterized after we have given Greef's description of his typical *Amœba terricola.*

This creature, found in dry earth and sand, looks exactly like a small particle of grit or silex, having a dull glassy surface, and a number of short, stiff, knoblike protuberances on its external surface. The body is of irregular shape, and divided by clefts or fissures; it contains in its interior a number of yellow or brown coloured granules, which are seen in pretty active motion, streaming hither and thither as they are impelled by the movement of the contractile sarcode. The locomotion of this land Amœba differs strikingly from that of the water species. Its external transparent ectosarc is of a much firmer and tougher consistence than that of the water Amœba, and the contraction of this ectosarc is much more powerful. The knotty protuberances do not spread with a smooth, flowing motion like the projected masses of the water Amœba, but remain stiff. The outer surface is wrinkled into folds, meeting and crossing each other when the animal collects its endosarc into a globular mass of comparatively small size (as, for instance, when resisting the pressure of the covering glass), exhibiting great contractile power. After a moment of rest, the animal projects its sarcode in a broad stream towards some point of its periphery, while at the opposite point the sarcode contracts and governs the direction of the forward movement until the animal falls over by change of its centre of gravity, and thus, by a series of rolling movements, it makes its way.[1] The projected arms appear to seek the free spaces between the particles of earth or sand in which the creature is moving, and thus the direction of movement follows the line of least resistance. The movement results from the strong contraction of the ectosarc at the point opposite to that of the yielding surface, which allows the endosarc to be pressed forwards. During these movements the whole of the interior can be seen in turn, and peculiarities of structure are thus best observed.

The distinction between the tough ectosarc and semi-fluid inner mass is much more marked in land than in water species of Amœbæ. Greef remarks that the body must be composed of two kinds of plasm greatly varying in consistence and physical appearance; the outward hyaline ectosarc, firm in substance, the inner mass soft and granular.

Wallich and Carter have noticed a similar differentiation even in water species. Wallich distinguishes the outer and inner portions as ecto and endo sarc, but appears not to have found any differentiation of contractile capacity or physical constitution. Carter recognizes a difference of substance and property between the outer and inner sarcode. In the clear ectosarc, which, according to Carter, has a distinct membranous envelope, he places the locomotive and prehensile power, whilst in the soft endosarc he recognizes a loose movement of the organic particles on each other—*i.e.*, a rolling movement. Carter also considers that the ectosarc is chemically as well as physiologically different from the endosarc, having found that the ectosarc turns purple on application of iodine.

In fresh-water Amœbæ, the inner sarcode is often, during forward movement, projected through the outer rind to its very edge. This is not the case with the land Amœbæ. The layer of ectosarc forming the boundary of the advancing mass shows a deep border of clear unwrinkled yielding sarcode, whilst the portion of ectosarc at the opposite side of the body is contracted into firm folds; the endosarc takes at first no active part in contraction, but is impelled forwards as the advancing front yields and spreads out. The ectosarc alone performs the functions of muscle-envelope, such as is seen in Mollusca. In comparison, therefore, with the sarcode of the water Amœbæ, this ectosarc shows an advance in special function approaching that of muscle.

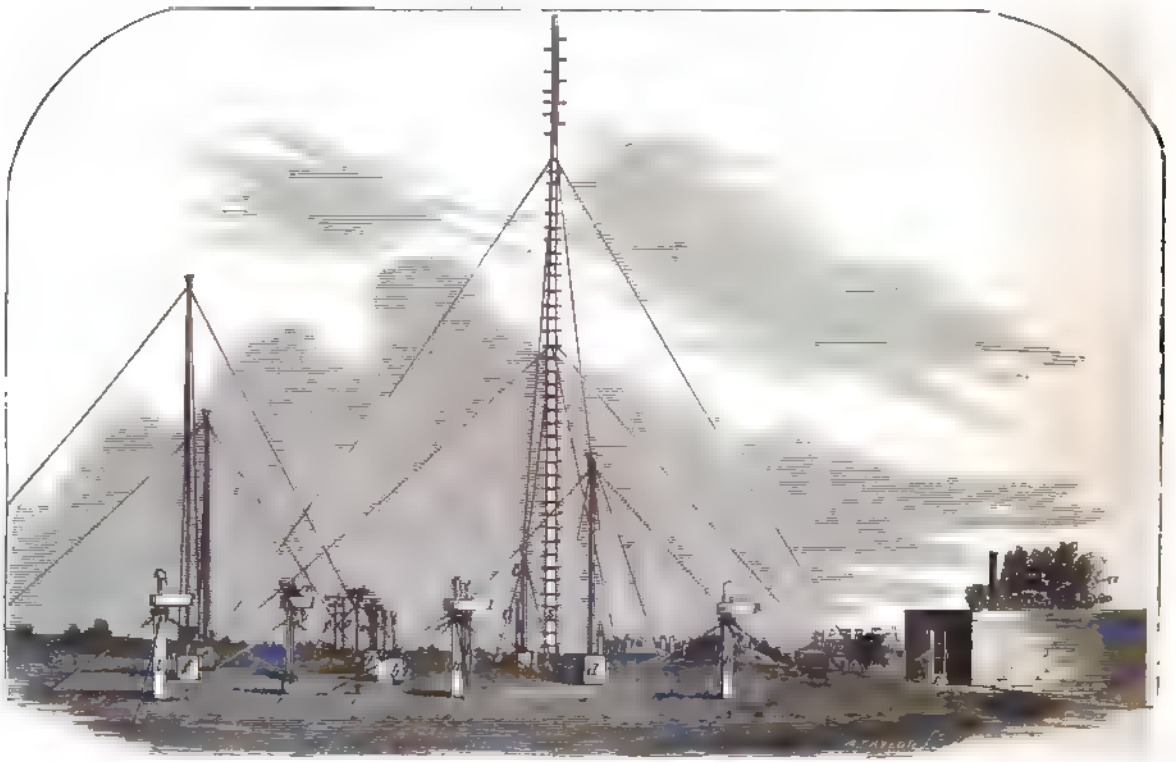
Is this enveloping ectosarc invested with membrane? Greef maintains that it is *not*, and further that its inner surface or border is not sharply defined, or separated from the inner sarcode. The lines and folds seen on the exterior are occasioned by the compression resulting from the construction of the ectosarc, which Greef conceives to have acquired a muscular character, though not strictly possessing the appearance of a muscle substance. The reactions of acids, alkalies, iodine, &c., do not indicate the existence of any membrane. The inner mass is a granular, soft protoplasm, not contractile. In it are seen transparent vacuoles, either in bubbles or cavities filled with fluid. These are of various size, and change place quickly under pressure of contractile action. They sometimes run together, forming a large bubble, at other times break up into a number of smaller ones. When the creature is motionless, a large bubble will slowly work its way to the periphery, then break into a group of smaller vesicles which gradually unite again into a bubble of the original size. They can, therefore, have no membranous wall, and are not contractile.

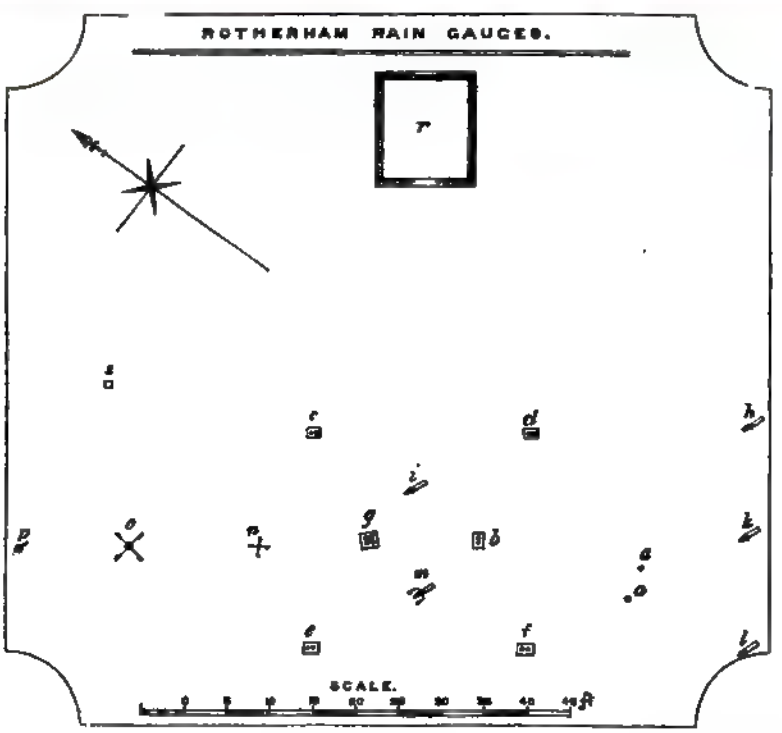
In the endosarc are found other contents—diatoms and algæ, taken in as food. Besides these there are seen highly-coloured yellow or brown particles which have often a distinct form, and contain a distinct nucleus. Sometimes these particles are agglomerated together, and the whole group is surrounded by a clear space. Sometimes a diatom or alga is included. Greef thinks these coloured particles subservient to digestion of food, and compares them with the yellow cell-like bodies of many lower animals (so-called liver cells)—in any case they are not a portion of the reproductive system.

Other crystalline particles are also seen, which Greef considers to be excretion. Auerbach, Wallich, Carter, and others, have seen the same kind of particles in all Amœbæ and certain Rhizopods.—*Proceedings of the Bristol Naturalists' Society*, vol. iv. part 2.

[1] This movement cannot be called creeping. When, by a change of centre of gravity, the animal rolls over, the firm protuberances do not yield or flatten, but present blunted ends, on which, as on points of leverage, the creature is upheld in its rolling gait backwards or forwards. The movement is often very active, and carried on with energy and grace.

EXPERIMENTAL RAIN-GAUGES, BOSTON RESERVOIR, ROTHERHAM, YORKSHIRE.





a a	1 ft. gauges	g	5-mouthed gauge		n	Robinson's anemometer	
b	5 ft. ,,	h	Inclined revolving gauge,	22½°	o	,, ,,	(Guest & Chrimes)
c	10 ft. ,,	i	,, ,, ,,	45°	p	Vane	
d	15 ft. ,,	k	,, ,, ,,	67½°	q	Thermometers	
e	20 ft. ,,	l	,, ,, ,,	90°	r	Office	
f	25 ft. ,,	m	Tipping ,, ,,		s	Water Company's Indicator.	

ROTHERHAM EXPERIMENTAL RAIN-GAUGES.

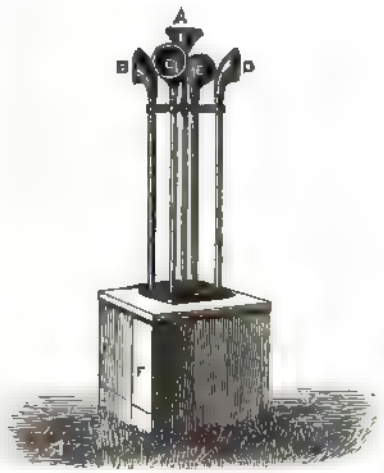


Fig. 1.

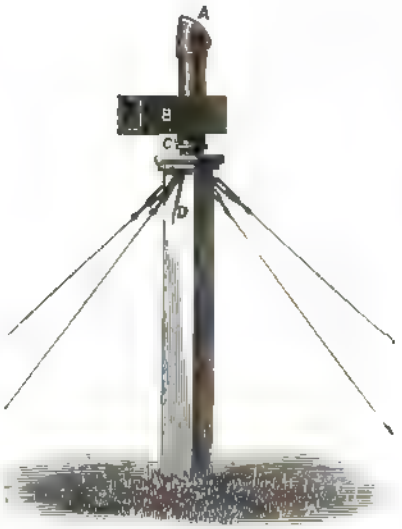


Fig. 2.

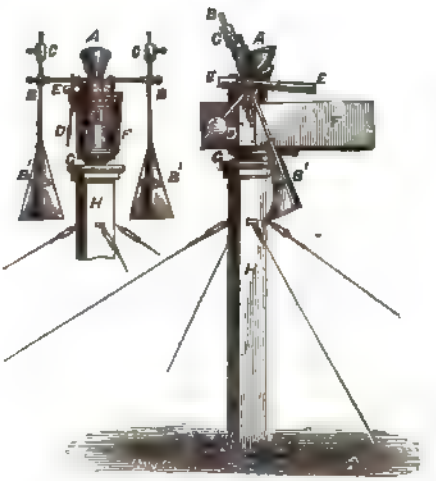


Fig. 3.

Fig. 4.

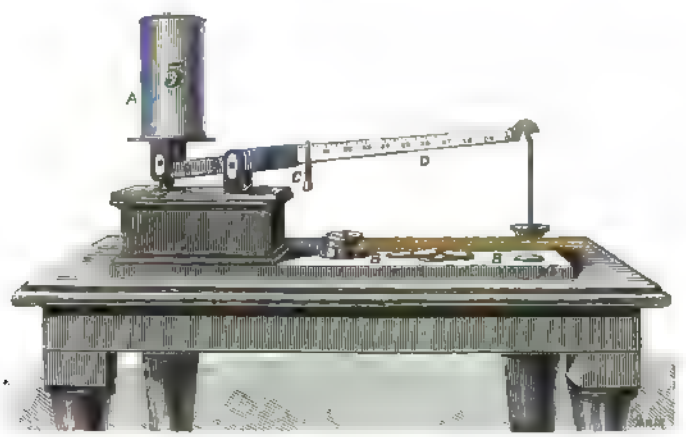


Fig. 5.

DESCRIPTION OF THE ROTHERHAM EXPERIMENTAL RAIN-GAUGES.

BY G. J. SYMONS, F.M.S.

During the last four years a series of gauges, novel and, in many respects, unique in construction and design, have been in continuous operation on a piece of elevated ground on the outskirts of one of our northern manufacturing towns—Rotherham, in the southern portion of the West Riding of Yorkshire.

The precise position is on the ground covering the reservoir which supplies the town with water; the surface is therefore perfectly level, clear of trees, and (as shown on p. 386) above the roofs of all surrounding houses. The only object rising above the surface-level being the tall indicator[1] belonging to the reservoir, marked *s*, and which we may as well state, once for all, has nothing whatever to do with the rain-gauges.

At the meeting of the British Association held at Birmingham, it was suggested that experiments should be made as to the relative indications of ordinary horizontal-mouthed rain-gauges, and of others specially constructed with their receiving surfaces inclined to the horizon, and kept towards the wind by vanes.

A month or two later, R. Chrimes, Esq., of Rotherham, offered to pay for any apparatus which might be required, to obtain from the local authorities permission to use the reservoir inclosure, and to carry on any observations thought desirable. We need hardly say that this handsome offer was cheerfully accepted, and the construction of the following instruments was decided upon.

[1] It may not be amiss to explain this indicator, as there are many purposes for which, and places where, it might be usefully employed. It consists of a squared pole about 40 ft. long, with small cross-bars fastened on as steps as far as the upper set of guys, above these the pole is crossed by horizontal bars, projecting from alternate sides, at each foot of height. Inside the reservoir, and resting on the water in it, is a large float, from which a long iron rod passes through staples, up one side of the pole, and carries at its top a cross-bar reaching out on both sides. The position of this cross-bar, therefore, shows the depth of water in the reservoir, which, when the photograph was taken whence our frontispiece was engraved, was 4 ft. above the bottom and 8 ft. below the top. Owing to its elevation and size, the quantity of water in the reservoir can be read from the offices in the centre of the town. A modification of this arrangement would make a capital barometer indicator.

Five-Mouthed Gauge, fig. 1 (*marked g in view and ground plan*).—This instrument closely resembles one constructed more than thirty years since for Professor Phillips's experiments at York. It has, as its name implies, five distinct funnels, each having a separate receptacle for the rain collected. One of these funnels has its orifice horizontal, the other four have their orifices vertical, and face the cardinal points. Therefore, if rain falls perpendicularly, A collects the whole, and B, C, D, E, collect nothing. If B, C, D, E, are respectively supposed to be the mouths facing S., W., N., and E., and rain falls from the N. at an angle of 45°, equal quantities will be collected by the funnels A and D; if the quantities collected by these two funnels are unequal, the ratios of the amounts collected enable one readily to calculate the altitudinal angle at which the shower has fallen. A similar method applies to the several vertical mouths, so that by this instrument the angle both of altitude and azimuth whence the rain has fallen can be determined.

Inclined Gauges, fig. 2 (*and h, i, k, l in view and plan*).—Of these, one only (45°) was originally suggested, but three were added subsequently, so that there are now four; the mouths being inclined to the horizon $22\frac{1}{2}°$, 45°, $67\frac{1}{2}°$, and 90°; the original 45° gauge is the one represented by fig. 2. It will be seen to consist of a stout post D, supporting a pivot at C, on which all the upper part rotates; the mouth A is permanently inclined 45° to the horizon, and it is kept face to the wind by a powerful wedge-shaped vane, B. The other inclined gauges only differ from the one represented in the angle of the orifice, which of course in the case of that at 90°, is actually vertical.

Tipping-Funnelled Gauge, fig. 3 (*m in view and plan*).—It is evident that the maximum amount should be collected by a gauge kept both in altitude and azimuth exactly at right angles to the path of the rain. None, however, but those who have tried it can imagine how difficult it is to effect this even approximately. Some idea thereof may be formed from the annexed engraving, which represents the instrument in its present form; A is the receiving surface, which is rigidly attached to a horizontal axle, through the extremities of which pass two levers B B′, having at B′ a pair of vanes counterbalanced by the sliding weights C; both vanes and counterpoises can be clamped on any part of the levers, so as to enable the observer infinitely to vary their power over A. Of course, everybody sees at once, that in a dead calm the rods B B will be vertical, and the mouth of the gauge horizontal; if any wind arises it will act upon the vane F, and bring the gauge into position; then the fans B′ will be driven back by the wind, and the funnel A will rise to meet the rain; in the case of a hurricane the levers would become almost horizontal, and the mouth of the gauge vertical.

It was found, however, that some further steadying was required, to enable the apparatus to meet the complication arising from the continuing impetus of the raindrops during a lull. This has been mitigated, if not entirely overcome, in a very ingenious manner. A weight D was first added, set on at not quite a right angle to the levers B B′, and then there was added thereto a brass tube E E, inclosing a glass one containing mercury; over the axial point of the glass tube there is a bridge, having a small hole in the bottom, as in fig. 4. When the mouth A is tilted up, the mercury passes over the bridge into the small end, which thus becomes the heavier, and it is only as it gradually runs back through the small hole that the funnel A is able to resume its horizontal position.

The above, with the addition of a small Robinson's anemometer (*n*), were the instruments originally started.

Subsequently, not only have the three inclined gauges already mentioned been added, but also a larger anemometer (*o*), a vane (*p*), thermometers (*q*), an office (*r*), and a dozen gauges at different heights above the ground, viz., two at each of the following, 1 ft. (*a*), 5 ft. (*b*), 10 ft. (*c*), 15 ft. (*d*), 20 ft. (*e*), and 25 ft. (*f*). Duplicates are placed at each height, in order to compare monthly and daily readings.

Lastly, with a view to securing *perfect* accuracy in all the measurements (even to 0·001 in.), each gauge was numbered, a duplicate series of cans were provided, and similarly numbered and adjusted, till their weights were all identical. One set of cans is, therefore, always in the gauges, and the other set in a box prepared for them. When an observation has to be taken, all that has to be done out of doors is to exchange the cans. The full ones are then taken into the office and placed on the weighing-machine, fig. 5, which is provided with weights, B for each 0·10 in. and a sliding one C for the fractional parts, the steel-yard D being divided to show by simple inspection each thousandth of an inch.—*British Rainfall*, 1869.

REVIEWS OF BOOKS.

Etudes sur l'Origine des Basques, Par M. Jean François Bladé. Paris: A. Franck. 1869.

THE handsome, chivalrous, and enterprising Basque race, inhabiting the south-west corner of France and the adjacent portion of Spain, have long afforded a bone of contention to *savants*, and a problem most difficult and most complex. Their language, customs, and physiognomy distinguish them from the inhabitants of all other countries; and as yet the labours of Humboldt, d'Abbadié, Lucien Bonaparte, Prunes Bey, Michel, and others have not resulted in any very satisfactory theory of their origin. The language has been studied with considerable success; the customs — fast disappearing since the revolution—are by no means well known; and Basque craniology may be unhesitatingly said to be yet utterly unreliable. The admixture of other races is the great difficulty from an ethnological point of view; and this difficulty certainly obtains to a very considerable extent. Several different theories have been proposed regarding the origin of the Basques; the two best are, perhaps, that of Humboldt, which refers them to an ancient Iberian race, and that of d'Abbadié, which regards them as presenting a "*facies* Africanus." Unfortunately, it is extremely questionable whether any distinct race ever occupied Iberia; and the difficulties introduced by the African theory will be evident to the ethnologist. The notion that the Basques and the Finns are the remnants of Touranian aborigines is certainly fascinating, but terribly vague. The Basques are usually described as dark; but fair hair and blue eyes are very common in the neighbourhood of St. Jean-Pied-de-Port and other inland districts, where admixture of other races would not be specially expected. Regarding the hair and complexion of Basques (as also of Cagots), the most diametrically opposite accounts have been published, owing chiefly to too hasty generalization.

The work of M. Bladé is just what was most needed in the present state of these questions. Five hundred and fifty large octavo pages of serried criticism, original observation, clear *exposé*, and ample reference, afford the student a most satisfactory and thorough groundwork for judging the hasty generalizations of which the Basques are the perpetual victims. The author strictly applies the inestimable principle of proceeding from the known to the unknown, and through Philology, History, Anthropology, *Toponymie*, *Droit Coutumier*, Numismatics, &c., he endeavours to obtain sure footing as far as may be, while he refrains from introducing any hypothesis of his own. Such a work necessarily crosses vested interests and long-admired opinions, and M. Bladé has already met severe treatment at the hands of one or two critics. Regarding this, it should be observed that small errors of detail are unavoidable in a work like that of M. Bladé's, and that two questions must be considered regarding the criticisms, viz., whether they are correct, and whether they concern the main points of the work. M. Bladé's name is already well known in France as that of a most conscientious investigator, and his present work forms an

unusually valuable contribution to French science. A short appendix in reply to any noticeable criticisms will soon be issued to accompany the work.

A Guide to the Study of Insects, and a Treatise on those Injurious and Beneficial to Crops. By A. S. Packard, Jun., M.D. Concluding Parts, VIII., IX., and X. Salem. 1869.

We have now before us the concluding three parts of Packard's *Guide to the Study of Insects*, and have the pleasure of saying that they fully sustain the opinion we have more than once expressed of this admirable work. They contain the completion of the great Coleopterous division, followed by the Hemiptera, Orthoptera, and remaining orders. In the classification of some of the orders the author has introduced certain modifications which appear to be judicious. They are in some cases original, and in others founded on arrangements suggested by eminent European naturalists. The book bears unmistakable evidence that it is the production of a true, hardworking entomologist, who has himself observed what he describes. It is therefore of far more value to a student than any of the mere compilations so often put forward as popular handbooks could be. The book is excellent in every branch of information concerning insects, but is especially to be commended for its copious remarks on embryology, which is perhaps the most important part of the science.

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De la Viande crue (musculine Guichon) et des Potions alcooliques reconstituantes préparées à l'Abbaye de N.-D. des Dombes, par Villars (Ain). Traitement de la phthisie pulmonaire, des maladies consomptives, des débilités naturelles ou acquises, et de quelques autre maladies aiguës ou chroniques de l'enfance et de l'âge adulte. Par Ch. de C. Paris. J. B. Bailliére.

Etudes géologiques et paléontologiques sur l'Embouchure de la Seine et les Falaises de la Haute Normandie. Par G. Lennier, Conservateur du Musée d'Histoire naturelle du Havre. Le Havre. Costey.

Etude statistique et hygiénique sur la Diphtérie cutanée d'après la Relation de 32 Cas observés dans l'Arrondissement de St.-Jean-d'Angély (Charente-inférieure). Par M. Ph. Gyoux, Médicin adjoint des Hôpitaux de Bordeaux. Paris. Baillière et Fils.

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Etude sur l'Emploi du Gaz sulfydrique pour la Destruction du *Phylloxera vastatrix* ou Pouceron souterrain qui attaque les Racines de la Vigne, et sur l'Efficacité de ce Gaz contre l'Oïdium. Par V. Marchand, ancien élève de l'Ecole polytechnique. Perpignan. Latrabe.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

On Velocipedestrianism.—*From* W. J. Barkas, M.R.C.S. Eng., L.R.C.P. Lond.

Sir,—There is an old saying which runs thus, "What is one man's meat is another man's poison," that may be with great propriety be applied to all forms of bodily exercise. Every one knows the powers of endurance differ in different people; one person may be able to endure almost any amount of severe bodily exertion, while another cannot, but soon succumbs, not perhaps from want of inclination, but from the exhaustion of the nervous force supplying his muscular system, or perhaps from some defect in his frame.

To a great number of people, however, a certain amount of exercise is a great benefit, strengthening them and causing their health to be better, but the reverse is the case in those to all appearance may be healthy but have lurking in them some disease which is at present latent and only requires certain impulses to render them progressive and place their lives in danger as phthisis, certain forms of heart disease, &c. It is, therefore, clearly to be deduced from this that only those persons who are sure of their present state of health should indulge in any exercise which is at all violent, as riding on a velocipede. The mania which sprang up some time ago for velocipedes is apparently dying out, for it is evident, from my experience at least, that they are not of the slightest advantage for making long journeys, if at the end of the ride, you are to be cool as regards temperature, have all your faculties clear, or your hand steady. Before pointing out the advantages of the velocipede, I shall assume that they are of no use for practical purposes and must only be used as an exercise for the body; also that the person using it has been previously assured that his respiratory and circulatory systems are in good order by his medical adviser. The advantages are that from the amount of muscular action brought into play it cannot but be of benefit to those in good health if the exercise be set in moderation; also as it generally necessitates riding along roads, it takes a town person out into the country and gives him fresh air, which he would probably not otherwise get; and finally, the sensation of going quickly through the air raises the animal spirits, giving a feeling of exhilaration similar to riding on horseback.

A beginner can generally learn to ride straight ahead on a bicycle, if he perseveres every day, in about a week, though I have known in some few cases two days practice sufficient. The first difficulty he has to cope with is want of confidence in the machine balancing after his feet are off the ground. When he has gained a certain amount of confidence, another and greater difficulty presents itself,—his inability to hold the guide firm. This is a consequence of the want of harmony between the arms and legs, for when the leg is pushing down the foot-rest, the guide has to be kept firm at that side, or the front wheel will be pushed to the opposite side, resulting in a loss of balance and a certain fall. All these difficulties, however, are overcome after a few bruises; the learner then can go forward at a moderate pace for a short distance, when he finds that the muscles of the forearm and arm and those round the shoulder begin to ache, and the muscles of the thigh seem to lose their power. The reason of this is that an entirely new set of muscles are brought into action—viz., the flexors of the fingers, which are kept in a permanent state of contraction that the guide may be held firm and straight; the biceps, which holds the elbow steady and flexed; the muscles around the shoulder, which keep the arm firm and fix it to the side; all these muscles being more contracted at each alternate movement of the feet.

In the action of the legs it is the muscles of the thigh that are principally brought into play, the flexors of the leg and those that flex the thigh on the body raise the leg as the foot-rest rises, and the extensors of the thigh and leg force the foot-rest down again. The greater part of the exertion falls upon the extensors of the thigh.

Many of the muscles of the back and abdomen are slightly exerted when the rider begins to make circles, turn corners, &c., that he may not lose his balance.

The feeling of want of power gradually disappears as the rider becomes more and more proficient in the exercise.

I have placed these few remarks before you, as the season is again approaching when velocipedes will be used, in the hope that my experience may be of service to intending velocipedestrians.

I am, &c.,

Boro' Bridge. W. J. Barnas, M.R.C.S.Eng., L.R.C.P.Lond.

Chemical Errors.

Sir,—Will any of your readers kindly explain to me the following peculiarities which I observed in a late number of a so-called scientific serial which attempts to give chemical news? (1) The *specific gravity* of the tube will be a little in excess of the *weight of water* which it displaces. (2) Carbon moxide, hydroge sulphate, silver vanadat, which are evidently specimens of a new nomenclature. (3) The following (to me unknown) formulæ:—$Na_2\ VO_4 + 16H_2\ O_2$, and $3Pb_2\ VO_4 + PbC.\ l_2$.

I am, &c.,

April 25. A Chemical Student.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

At the last meeting the following papers were read:—"On the Constituent Minerals of the Granites of Scotland, as compared with those of Donegal," by the Rev. Samuel Haughton, M.D. Dub., D.C.L. Oxon., Fellow of Trinity College, Dublin.—During the past summer (1869) I completed my investigation of the constituent minerals of the Scotch granites, and secured specimens, from the analysis of which I obtained the following results:—

I. *Orthoclase.*

	No. 1.	No. 2.	No. 3.	No. 4.
Silica	65·40	64·44	64·48	64·48
Alumina	19·04	18·64	20·00	20·00
Peroxide of iron	trace.	0·80	none.	none.
Lime	0·22	0·66	1·01	0·78
Magnesia	trace.	trace.	trace.	none.
Soda	3·63	2·73	1·72	2·19
Potash	11·26	12·15	12·81	12·10
Water	0·20	0·80	0·64	0·08
	99·75	100·22	100·66	99·63

No. 1. Stirling Hill, Peterhead.—Occurs in an eruptive granite, in veins, in well-developed reddish-pink opaque crystals, encrusted with crystals of albite.

No. 2. Rubislaw, Aberdeen.—Large beautiful reddish-pink opaque crystals, in veins, associated with white mica. The granite of Rubislaw is of metamorphic origin, and different in character from the eruptive granite of Peterhead. No albite has been found in it.

No. 3. Peterculter, Aberdeen.—In metamorphic granite; white, translucent, large crystals.

No. 4. Callernish, extreme west of Lewis.—In metamorphic granite; in large grey crystals, with a slight shade of pink, translucent.

The oxygen ratio of these felspars is as follows:—

	No. 1.	No. 2.	No. 3.	No. 4.
Silica	33·956	33·456	33·478	33·477
Alumina, &c.	8·898	8·950	9·348	9·348
Lime	0·061	0·187	0·286	0·221
Soda	0·929	0·699	0·440	0·561
Potash	1·908	2·059	2·171	2·051
	45·752	45·351	45·723	45·658

From this table we find the oxygen ratios:—

	No. 1.	No. 2.	No. 3.	No. 4.
Silica	11·87	11·35	11·55	11·92
Peroxides	3·06	3·04	[illegible]	3·30
Protoxides	1·00	1·00	1·00	1·00

The granites of central and western Scotland are metamorphic rocks, like those of Donegal and Norway, with which they are geologically identical; and truly eruptive granite occurs at only a few localities, as, for example, near Peterhead.

The second felspar, associated with Orthoclase in the metamorphic granites, is Oligoclase, as in Donegal; while the second felspar associated with Orthoclase in the eruptive granites, is albite, as in Mourne, Leinster, and Cornwall. The fact this indicated by the Scotch granites is completely in accordance with the mode of occurrence of Oligoclase and albite in the Irish granites.

II. *Oligoclase.*

	No. 1.	No. 2.
Silica	62·00	61·88
Aluminia	23·20	24·80
Magnesia	——	Trace.
Lime	4·71	4·93
Soda	9·20	8·12
Potash	0·43	0·98
	99·54	100·71

No. 1.—This Oligoclase occurs in the granite of Craigie Buckie, near Aberdeen; it is white and opaque, and so much resembles Cleavelandite in appearance as to have been mistaken for that variety of albite; its analysis proves it to be Oligoclase. The crystals do not exhibit striation.

No. 2.—From the granite of Rhiconish, in the west of Sutherlandshire; it is greyish white, semi-translucent, in large striated crystals, and resembles the Oligoclase of Ytterby, in Sweden.

The oxygen ratios of the Oligoclase are as follows:—

	No. 1.	No. 2.
Silica	32·191	32·128
Alumina	10·843	11·590
Lime	1·339	1·400
Soda	2·360	2·082
Potash	0·072	0·165
	46·805	47·365

Hence we obtain:—

	No. 1.	No. 2.
Silica	8·54	8·82
Peroxides	2·88	3·18
Protoxides	1·00	1·00

These oxygen ratios prove the felspars to be Oligoclase.

III. *Albite.*

Silica	68·00
Alumina	20·00
Lime	0·35
Magnesia	trace.
Soda	10·88
Potash	0·68
	99·91

This albite occurs at Stirling Hill, near Peterhead, in eruptive granite, and is found associated with red Orthoclase in veins. It encrusts the large crystals of Orthoclase, and is semi-translucent; and is generally stained on the surface by peroxide of iron.

Oxygen Ratios.

Silica	35·306	11·77
Alumina	9·348	3·11
Lime	0·099	
Soda	2·790	1·00
Potash	0·114	

This mineral is evidently a typical albite.

There are two kinds of mica found in the Scotch granites, and both micas resemble very closely the corresponding minerals of the Donegal granites.

IV. *White Mica.*

Silica	44·40
Fluosilicon ($Si\ F_2$)	0·16
Alumina	37·36
Peroxide of iron	2·04
Lime	0·78
Magnesia	0·57
Soda	0·93
Potash	9·87
Protoxide of manganese	0·24
Water	1·84
	96·19

The specimen of mica here analyzed came from veins in the granite quarry of Rubislaw, near Aberdeen, and occurs in large plates, associated with red Orthoclase. It was carefully examined for lithia, but no trace of this alkali could be found in it.

The angles of the rhombic plates were 60° and 120° exactly, and the angle between its optic axes was found to be 72° 30′.

The black mica, in large crystals, is very rare, but it seems abundantly disseminated, in minute scales, through most of the Scotch granites. The following analysis was made on specimens found near Aberdeen by Prof. Nicol, and kindly forwarded to me by him, for the purposes of this paper:—

V. *Black Mica.*

Silica	36·50
Alumina	16.50
Peroxide of iron	18·49
Lime	1·11
Magnesia	7·44
Soda	0·92
Potash	8·77
Protoxide of Iron	6·76
Protoxide of Manganese	1·80
Water	1·60
	99·89

This mica was carefully examined for fluorine, and found not to contain any.

"Researches on Vanadium. Part III. Preliminary Notice," by Henry E. Roscoe, B.A., F.R.S.—This paper is too long and too purely technical for abstract in these pages.

GEOLOGICAL SOCIETY.

April 13th.—Sir P. de Malpas Grey Egerton, Bart., M.P., F.R.S., vice-president, in the chair. S. W. North, Esq., of Castlegate, York, was elected a fellow of the society.

The following communications were read:—A letter from Dr. Gerard Krefft, dated Sydney, 29th January, 1869, accompanying a model of the left lower incisor of *Thylacoleo carnifex*, Owen, and the original fragment from which the model was made. Dr. Krefft also referred to the fossil remains of herbivorous marsupials in the Museum at Sydney, which included, according to him, besides a great number of Wombats (Phascolomys), many wombat-like Kangaroos or Wallabies (Halmaturus). He proposed to divide the Kangaroos into the following groups:—1. Macropus, dentition as in *Macropus major*. 2. Halmaturus, with the premolar permanent, divided into two subgroups: *a*. True Wallabies, with the premolars long, narrow, and compressed, and the rami of the lower jaw but slightly anchylosed; *b*. Wombat-like Wallabies, with the premolars compact, rounded, and molar-like, and the rami of the lower jaw firmly anchylosed. Illustrative sketches and photographs accompanied this paper.

Discussion.—Prof. Owen remarked upon the importance of the researches made by Dr. Krefft and Prof. Thompson. No traces of man had been found. The numerous remains of mammals, especially the herbivorous species, had doubtless been carried into the caves by Thylacoleo.

Prof. Busk inquired on what evidence Prof. Owen decided that the tooth of Thylacoleo was that of a carnivore.

Prof. Owen indicated the remarkable compression of the tooth and the absence of the spatulate form proper to the Kangaroos as characteristic of Thylacoleo and indicative of carnivorous habits.

Mr. W. Boyd Dawkins stated that Thylacoleo was most closely allied to Plagiaulax, which was probably a true herbivore. He indicated the importance of the question, as, if Thylacoleo were a carnivore, Plagiaulax would be one also.

Prof. Owen remarked that Plagiaulax was also a carnivore. The premolars resembled the small tubercular molars of the Hyænas, Felidæ, &c. The anterior tooth, associated with the small tubercular tooth, was compressed and sharp pointed. The low condyle, forming part of the angle of the jaw, was such as occurs in Thylacinus.

Dr. Duncan remarked that it is by no means necessary that all carnivorous mammals should be formed upon the same type, and that he did not see why there should not be a carnivorous form of the Kangaroo type.

The chairman said that the settlement of these questions must now be postponed until we obtain further materials. He mentioned the discovery by Dr. Krefft, in the interior of Australia, of a species of fish resembling Lepidosiren, and possessing singular affinities to some of the Devonian fishes.

"On the Fossil Remains of Mammals found in China," by Prof. Owen, LL.D., F.R.S., F.G.S.—The specimens of teeth described by the author were obtained by Robert Swinhoe, Esq., late H. M. Consul at Formosa, chiefly by purchase in the apothecaries' shops at Shanghai. They included two new species of Stegodon (named *S. sinensis* and *S. orientalis*), a new Hyæna (*H. sinensis*), a new Tapir (*Tapirus sinensis*), a new Rhinoceros (*R. sinensis*), and a species of Kaup's genus Chalicotherium (*C. sinense*). The author remarked that the whole of these teeth presented an agreement in colour, chemical condition, and matrix which led to the conclusion that all belonged to the same period. But for the presence of the Chalicotherium, they would have been referred either to the Upper Pliocene or to the Post Pliocene period. The author did not consider that the occurrence of one Anoplotherioid species need affect the determination of the age of these fossils, especially as Chalicotherium departs in some respects from the type genus Anoplotherium, and is not known from deposits older than the Miocene.

Discussion.—The chairman called attention to the remarkable association of forms among the fossils described by Prof. Owen.

Prof. Busk remarked that the materials at command seemed to him insufficient for the establishment of new species. He observed that the distinctive characters of *Stegodon sinensis* appeared to be very slight, and that the Hyæna was probably *H. spelæa*. The tooth of Rhinoceros might be a milk-molar of *R. sumatranus*.

Mr. Boyd Dawkins suggested that, as the specimens were obtained from apothecaries, there was no evidence of the contemporaneity of the fossils.

Mr. H. Woodward stated that Mr. Swinhoe had himself obtained a series of these fossils from a cave many miles inland, he believed on the course of the Yang-tse-kiang. Mr. Woodward also called attention to Mr. Hanbury's paper "On Chinese Materia Medica," in which many fossil teeth of mammalia are noticed.

Prof. Owen, in reply, stated that great quantities of the fossils had passed through his hands, and that he had selected for description those which, from their minute agreement in chemical and other characters, might justly be inferred to be derived from caves of the same age.

"Further Discovery of the Fossil Elephants of Malta," by Dr. A. A. Caruana; communicated by Dr. A. Leith Adams, F.G.S.—The author described a new locality in Malta in which the remains of elephants had been found recently—the Is-Shantiin fissure at the entrance of Micabbiba. It was filled with a compact deposit of red earth containing fragments of limestone, many teeth and fragments of bones of elephants, associated with bones of large birds. The author found three small shark's teeth, and a small tooth which he regarded as belonging to hippopotamus. He indicated the nature of the teeth and bones of elephants found by him in the newly discovered fissure. The whole of the five localities in which ossiferous fissures have been discovered are in the same part of the island; and the author concluded with some remarks upon the geological conditions under which the remains of mammalia must have been accumulated, and upon the probability that a connection then existed between Malta and Africa.

In a note appended to the paper Dr. A. Leith Adams stated that the supposed tooth of hippopotamus was a germ true molar of one of the pigmy elephants, and that the shark's teeth have probably been derived from the Miocene deposits.

Discussion.—Prof. Busk remarked that there was no doubt that three species of elephants had lived in Malta.

Capt. Spratt said that it appeared to him that the chief interest of the communication lay in the greater comparative abundance of the larger species of elephant in the new locality.

VICTORIA INSTITUTE.

An ordinary meeting was held on Monday week last, at 8, Adelphi-terrace, Mr. Reddie in the chair. A paper was read "On True Anthropology; or, the Spiritual, Mental, and Physical Constitution of Man," by Dr. W. Hitchman, of Liverpool.—The paper gave rise to an animated discussion, in which the following gentlemen took part: Dr. Dendy, Dr. Haughton, Sir Tilson Marsh, Rev. R. Greaves, Rev. C. Graham, Rev. C. Row, and the chairman.

ROYAL HORTICULTURAL SOCIETY.

The fortnightly shows of the Royal Horticultural Society increase in interest with the advance of the season; although the nuisance of unfinished buildings is a great drawback to the pleasure of visitors. At the meeting last Wednesday the chief features were the azaleas and rhododendrons. Among the former may be noticed especially the pink white-edged Belle Gantoise, the white Queen Victoria, striped with rose colour, and Roi Leopold, of a bright red. There were some admirable specimens of orchids, a fine collection of roses, and some interesting groups of hardy spring flowers. Mr. W. Wilson Saunders, F.R.S., presided at a general meeting held in the council-room in the afternoon, when the following candidates were elected fellows of the society, viz.: General E. P. Buckley, Hon. Mrs. Yarde Buller, Charles Salisbury Buttler, Henry Cheswright, W. Crawford, Col. Charles Denison, Mrs. Ormsby Gore, Thomas Harbottle, George Marten, Mrs. David Mocatta, Thomas Mott, Charles K. Prioleau, A. M. Silber, &c.

SUNDAY LECTURE SOCIETY.

The first of the second series of lectures, under the auspices of the Sunday Lecture Society, was delivered last Sunday, the 24th inst., in St. George's-hall, Langham-place, by James Glaisher, Esq., F.R.S., F.R.A.S., the subject being, "The Balloon: History of its Discovery, and Mr. Glaisher's Experience in its Application to Useful and Scientific Researches." The hour for the delivery of the second series of these Sunday lectures has been wisely changed from 4 o'clock in the afternoon to 8 o'clock in the evening, by which time, on this occasion, the spacious galleries of the hall were well filled with a highly respectable middle-class audience; a fair sprinkling of persons occupying the body of the hall.

The lecturer, who was warmly received, after shortly referring to some of the interesting facts disclosed by Dr. Carpenter in his lecture on "Animal Life in the Deep Sea," commenced by giving a very brief sketch of the history of the Balloon's discovery. After explaining the various objects he had in view in making his numerous ascents, and giving an interesting account of the nicety and care required in the process of filling the balloon, Mr. Glaisher proceeded to describe, by the aid of coloured and figured diagrams, several of his aërial voyages, performed in company with Mr. Coxwell.

Commencing with one ascent made in fine weather with a clear sky, and rousing the enthusiasm of the audience by his graphic and tempting description of its pleasurable character, he proceeded to give particulars of other voyages, made when the sky was only "partially clear" and when "totally clouded," concluding by an exciting account of his memorable ascent to the enormous height of seven miles, when, both he and Mr. Coxwell, narrowly escaped with their lives.

The lecture was thoroughly popular in style, and was listened to with undivided attention: it lasted over an hour. The audience were fully impressed with the fact that, coupled with the pleasure and profit to be derived by making balloon-ascents, there are numerous risks and great dangers to be encountered, even with so clever and practical a companion as Mr. Glaisher.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, April 5th.—J. P. Joule, D.C.L., L.L.D., F.R.S., president, in the chair. Mr. J. S. Kipping and Mr. W. Mellor were appointed auditors of the treasurer's accounts. Mr. Binney, on behalf of Mr. Bernard Hartley Green, of Hopwood Avenue, presented to the society the MS. journal of Mr. George Walker, one of the original members. This contained many useful and interesting meteorological and other observations, with lists of prices of cotton, and notices of the first steam-engines in Manchester.

"Description of a New Anemometer," by Mr. Peter Hart.—On the appearance of Mr. Fletcher's admirable paper "On the Speed of Air in Flues," it appeared to me that an anemometer more easily read and less costly than his was desirable. With this view I devised the present one, which may be broadly described as a common U-tube gauge laid in a sloping position so as to form the hypothenuse of a right-angled triangle, the perpendicular of which is the true reading.

The following description will explain its construction:—

It consists first of a base board furnished with levels and levelling screws; to this is hinged the board carrying the U tube, which may be called the sloping base; on this sloping base is secured the U tube furnished with a scale and vernier capable of being read to the $\frac{1}{100}$ in. By means of a screw passing through the sloping base, and resting on the lower base board, the former can be made to assume any angle with the latter, the angle being determined by a quadrant fixed to the lower base board.

By this arrangement a very great degree of accuracy in reading is obtainable. Thus in the present instrument the quadrant is set 5 in. distant from the hinge, and when set at 0·5 in. on the quadrant it gives a rise of 1 in 10; consequently the ether in the U tube has to move 10 in. for 1 in. of vertical rise.

I had no little difficulty in my first efforts to restrain the excessive oscillations of the ether column, owing to the almost constant fluctuations of draught in flues. To obviate this the tube was choked to a narrower bore at the bend. This proving insufficient, I overcame the defect by the very simple means of inserting a piece of sponge at this part.

It is perhaps needless to add that it is necessary to employ Mr. Fletcher's tubes for insertion into the flue, and also his tables.

Mr. W. L. Dickinson read a paper "On the Eclipse of the Sun, December 21–22, 1870."—This eclipse begins in the North Atlantic Ocean; the line of central and total eclipse, moving in a south-easterly direction, crosses Portugal a little to the south of Lisbon; passing over part of Spain and the Mediterranean Sea, it enters Africa near Oran, and soon afterwards attains its extreme southern limit; the shadow of the moon, now moving in a north-easterly direction, leaves Africa, and crossing the island of Sicily, the south of Turkey, the Black Sea, and the Sea of Azof, disappears; the penumbra of the moon, decreasing rapidly, leaves the earth with the setting sun in Arabia. The sun will be centrally and totally eclipsed at noon, in lat. 36° 28′ N., long. 5° 1′ W., a little to the north-east of Gibraltar.

The eclipse as seen in England will be partial; and as the sun will be at its greatest southern declination, it has not been considered requisite to perform the labour of computing from the Elements of the Eclipse.

"On the influence of Changes in the Character of the Seasons upon the Rate of Mortality," by Joseph Baxendell, Esq., F.R.A.S.—The general results of this investigation may be briefly recapitulated as follows:—1. That the influence of meteorological causes in producing fluctuations in the rate of mortality is much greater than that of any other recognized influence. 2. That the class of diseases which is most affected by meteorological changes is class I., Zymotic diseases. 3. That the relative increase in the number of fatal cases of disease at different ages, in unfavourable seasons, is greatest between the ages of 25 and 75 years, or amongst those classes of the community who are most exposed to vicissitudes of weather. 4. That the sanitary measures which have been carried out during the last 15 to 20 years by boards of health, health committees, and officers of health, have produced no perceptible improvement in the state of the public health, nor checked the growing increase in the rate of mortality, notwithstanding the enormous outlay they have involved; and that, therefore, a thorough reform of our existing sanitary system is urgently required.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

At the meeting held March 8th, a paper was read by Mr. James Lancaster "On the Microscope Dissected and Practically Illustrated."—It commenced by showing that such was the importance of the microscope, and the parts entering into its construction so many and varied, that, in order to enter fully into the subject, a number of papers would be required. The author stated, that whilst many valuable papers had, from time to time, been brought before the society of work accomplished by the microscope, the instrument itself had been neglected, and the effects produced by it, due to the optical and mechanical principles involved in its construction, had been passed over in silence. Mr. Lancaster then proceeded to describe its various parts, dwelling at greater length on those which he considered to be the least understood. Special reference was made to the object and eye pieces, the micrometer, and the camera-lucida, the merits and defects of which were pointed out and explained.

The meeting on the 15th March was devoted to a conversazione and exhibition of specimens.

At the meeting of March 22, Mr. W. Mathews, M.A., read a paper entitled "The History of the Exploration of the Nile-Basin."—He commenced by observing that of all geographical problems of the present day the position of the sources of the Nile has an interest far surpassing any other, from the length of time during which it has baffled every attempt at solution, and from its forming one of the most glorious chapters in the annals of British enterprise and courage. Omitting the history of the earlier explorers, and coming down to modern times, Mr. Mathews referred at length to the celebrated journey of James Bruce, in 1770, which resulted in the discovery of the sources of the Blue Nile. About the middle of the present century, a German missionary, Dr. Krapf, was joined by two others of his countrymen, Rebmann and Ehrardt; and their journeys to the foot of Kilimandjaro, and the other snowy mountains in the east of Africa, gave the first impulse to the series of expeditions which will ultimately unfold to us the entire geography of the Nile-basin. In 1857, Messrs Burton and Speke started for the interior of Africa, from Zanzibar, and in the early part of the following year discovered Lake Tanganyika. The next journey of importance was that undertaken by Captain Speke and Grant, who started from Zanzibar, and who, on the 21st July, 1861, stood on the banks of the Nile as it issues from the Victoria Nyanza. The two travellers on their return visited Gondokoro, at which place they met with Sir Samuel and Lady Baker, then about to commence that expedition which led to the discovery of the second great reservoir of the Nile—the Albert Nyanza. Mr. Mathews concluded an interesting paper by briefly describing the geographical labours of the illustrious explorer, David Livingstone, who has added more to our knowledge of the African continent, south of the equator, than all other travellers combined. The fears which have long been entertained of his safety may now be said to be happily set at rest by the arrival of letters from him addressed to Dr. Kirk, and by the still more recent, but indirect, intelligence that in July, 1869, he was Ujiji. Supposing him to be carrying out his intention of following out the eastern line of drainage down to Baker's turning point, it might yet be many months before we should receive intelligence from him.

At the meeting of March 29th, Mr. W. Nelson read a paper "On the Limnæidæ of the Birmingham district."—After pointing out the position of this family among the Mollusca, Mr. Nelson proceeded to describe certain peculiarities which some of them possess. The family is

met with in the greatest abundance in Central America, but in Great Britain is restricted to the four very distinct genera, Planorbis, Physa, Limnæa, and Ancylus. Of the genus Planorbis twelve species are met with in England; one of these, *P. duatatus*, being a recent addition, supposed to have been introduced in cotton from America. Of the remaining eleven species, ten have been found around Birmingham, besides four varieties that have been described as species by different authors. The genus Physa comprises but two species, both of which are met with in this neighbourhood. There are eight species of Limnæa in Great Britain, six of which occur in this district, and twelve varieties, but the distinctions between some of these are so trivial as hardly to entitle them to that rank. The other two species, *L. involutus* and *L. glutinosa*, are extremely rare, and are seldom met with, except in those localities in which they were originally discovered. Of the fourth genus, Ancylus, there are only two species, both of which are found around Birmingham. The total number of species of the family Limnæidæ, which have been found in this country, is twenty-three; and of these, twenty may be taken within a radius of five miles from this town, besides twenty-two varieties, thus showing that the neighbourhood is favourable to the development of this family. The paper was the result of Mr. Nelson's original observations, and afforded an excellent example of the indefatigable exertions of that gentleman in this branch of our local fauna. It was illustrated by a beautiful set of shells, and included a curious series of distorted specimens of *Planorbis complanatus* collected by Mr. Nelson, in the neighbourhood of Leeds. The thanks of the society were unanimously accorded to Mr. Nelson for his admirable paper. In addition to the above shells, Mr. G. S. Tye exhibited a large series of the genera Planorbis, Physa, and Limnæa, from North America.

NORTH STAFFORDSHIRE NATURALISTS' FIELD CLUB.

The first excursion of the season took place on Wednesday, April 20, when a visit was paid to Eccleshall. The exceeding fineness of the day drew together a large gathering, nearly sixty members being present. The first point of interest was the fine old church, which has been restored by Mr. Street in honour of Bishop Lonsdale, the last Bishop of Lichfield who occupied the castle. The general character of the architecture of the church is Perpendicular, with the exception of the chancel and the lower part of the tower, which are Early English. The principal features of the church were pointed out by the vicar, the Rev. C. P. Good, and his curate. There are several monuments in the church, almost all of them of former bishops of the diocese. In the centre of the old oak screen, which separates the chancel aisle from the north aisle is carved the following inscription:—

"Orate pro animâ Ric: Howel et Margaretta uxore ej."

It was up to this screen that the fire extended which broke out the first time that the flues were heated after the restoration, and which destroyed the woodwork of the north aisle and the adjoining part of the nave. Traces of the fire may easily be seen on the walls, and on the inscription just mentioned. Many of the party ascended the tower, from which a fine view of the neighbourhood is obtained. In the tower, during the progress of the restoration, was discovered a doorway above the tower arch, and a second one on the outside wall, but not corresponding to that on the inner wall. Not even a conjecture can be formed as to their original use. Having carefully examined the church, which is really a most interesting one, and well worthy of a visit, the party proceeded through the churchyard, and, by a private walk, through the grounds, to the castle, stopping to look at the fine memorial cross, of Aberdeen grey granite, erected, from a design by Mr. Gilbert Scott, over the grave of Bishop Lonsdale. Eccleshall Castle was erected in its present form by Bishop Lloyd in 1660, on the site of the original one. It is a plain low building of two stories, of stone. The old castle, which was restored by Walter de Langton at the end of the 13th century, was quadrilateral in form, with a tower at each angle, only one of which remains, and is in a tolerable state of preservation; a very pretty little window is quite perfect, and of beautiful proportions: the castle was moated, and the moat walls exist in sound preservation.

The party having assembled on the greensward, a general meeting of the club was held, under the presidency of Mr. Garner, when eleven new members were elected, and fourteen proposed for election; after which Mr. Yates, of Newcastle, proceeded to read a short paper on "Eccleshall and its Neighbourhood, together with some Observations on its Natural History." He said that as an old inhabitant of the place he was bound in honour to believe in its extreme antiquity. According to Pitt, in the time of Vespasian (A.D. 60), the Romans built here a temple to Jove, and as an act of duty the royal bird sacred to him forwith paid a visit to the temple. This happy omen was at once seized upon, and they called the place Eagle's Hall. So runs the legend. That the Romans were in the neighbourhood there is a convincing proof at Wooton, about a mile from the town—viz., the remains of a Roman road, and also indications of a fortified mansion. Bishop Muschamp built the castle, *circ.* 1200; it was rebuilt by De Langton a century later. Margaret of Anjou took shelter here after the disastrous battle at Blore Heath, where Lord Audley was slain in 1459, which she witnessed from the tower of Mucclestone Church. Mr. Yates mentioned that a place called the Hough, near the town, is held by the "Blests" under the tenure of the following doggerel:—

"While the ivy is green and the holly is rough
There is a house for Blest of the Hough."

Nearly all our inland birds are found in the neighbourhood of Eccleshall. At Copmere are seen sometimes wild swans and geese: sea birds are also frequent visitors there, as gulls, terns, and cormorants. Cootes and crested grebes breed there, as also does the reed warbler, which slings its curious nest high above the water between the stems of two or three reeds. A few years ago a flock of Sand Grouse (*Pterodes setarius*) visited the neighbourhood; they belong to China and Tartary. A pair of them were afterwards exhibited at the inn, and very handsome birds they are, of a light brown in colour, almost dove-coloured about the neck, feathered to the feet, and with wings and tail shaped like the swallow: they were kindly sent by Mr. Yates, of Eccleshall. Among the plants of the neighbourhood are *Lemna polyrhiza* and *gibba*, *Antirrhinum majus*, *Sambucus Ebulus* (dwarf elder), a rare plant, *Berberis vulgaris*, *Paris quadrifolia*, *Cochlearia danica* (on the roofs of houses in the town), Tutsan (in Castle gardens), *Parnassia palustris*, a peculiar species of maple (*Acer*) at Offley, vulgarly said to have sprung from a stake thrust through the body of a suicide. A vote of thanks to Mr. Yates for his paper, and to Mr. Jervis for his kindness in opening his grounds to the club, having been carried by acclamation, the greater number of the members proceeded to Copmere, some two miles away, by a pleasant route through fields and lanes, where the early spring flowers were glittering in the bright sunshine. Copmere is a natural piece of water, of some 60 or 70 acres in extent, the abode of innumerable wildfowl, and celebrated for its fish—pike especially. Here are several good plants, but the season is yet too early for marsh and water plants, so that no discoveries were made. On returning to the town a short visit was paid to the houses of Mr. Beckett and Mr. Greatrex, who very kindly and at considerable trouble received the members personally, and exhibited—the former some old paintings (cartoons) on leather of Scripture subjects, which had been in his family 200 years, and the latter an almost endless variety of curiosities, including fossils, &c. Then the party all met together for a substantial tea at the Royal Oak Inn, after which carriages were called into requisition—the Norton Bridge station being three miles away—and Eccleshall was left to its wonted quiet.

BELFAST UNITED NATURAL HISTORY SOCIETIES.

At a joint meeting of the Belfast Natural History and Philosophical Society and the Belfast Naturalists' Field Club, held in the Museum, on April 6, Robert Patterson, Esq., F.R.S., in the chair, the following papers were read:—"Illustrations of the Diffusion of Liquids," by Prof. James Thomson, LL.D.; and "The Aquarium," by Dr. Henry Burden.

Prof. Thomson referred to the experiments of Graham, late master of the Mint, and others, in which the phenomena of diffusion of liquids and of gases had been extensively investigated. The subject was one of great importance, not only on account of its intimate bearing on some of the most profound questions of physical research, and especially on questions as to the atomic constitution of matter, but also on account of its practical applications in affording the new and valuable methods for chemical analysis brought forward by Graham, and known as the processes of diffusion and dialysis. If two fluids capable of mingling with one another be placed in contact, a process of diffusion of each into the other will take place, even when the contact is made under conditions such as perfectly to avoid the production of circulating currents. To prevent currents, the chief thing to be done is to place the lighter fluid on the top of the heavier one. Thus, if water be placed in the lower half of a vessel, and alcohol, which is a lighter fluid, be placed gently, without commotion, on the top of it, so as to occupy the upper half of the vessel, the two fluids will diffuse into each other; or, if sulphuric acid—that is, oil of vitriol—be put into the bottom of a vessel, and water, which is much lighter, be put on the top of it, diffusion will ensue. The same would happen if syrup of sugar were put to the bottom, and water were placed above it, or if any kind of salt dissolved in water were put below and water above.

Diffusion takes place also between two gases. If the heavier one be placed below, and the lighter one above, the difference of density will tend to make each remain where it has been placed; but still the two will diffuse into each other till they are perfectly commingled. The diffusion of gases into one another proceeds very quickly, but that of liquids very slowly. Substances of a gelatinous character, of which glue is an example, and to which Graham has given the name colloids, will diffuse only with extreme slowness through one another, while salts and various other crystallizable substances, called by Graham

crystalloids, will diffuse quickly through them, but at various rates. This fact forms the basis of the process of dialysis, which consists in allowing diffusion of mixed substances to occur through a gelatinous or colloid partition. The parchment paper which is manufactured by immersing unsized paper in sulphuric acid, and then washing out the acid, is a good material out of which to form this partition. During the diffusion of mixed solutions through this parchment paper, some substances pass much more quickly than others, and so their separation can be effected. Very remarkable relations have been discovered to exist between the laws of the diffusion of fluids into one another, and the laws of the diffusion of heat through solids. In fact, when quantities or degrees of temperature communicated by conduction of heat are duly compared with quantities of one diffusable substance, transferred by diffusion into another, the law of diffusion in liquids is found to be identical with that of thermal conductivity. This discovery was first published by Fick, formerly Professor of Anatomy at Zurich.

Prof. Thomson showed to the society a mode which, during some years past, had been practised by his brother, Sir William Thomson, for illustrating diffusion and exhibiting its great slowness when circulating currents are avoided. Some glass tubes of about a ½ in. or ¾ in. bore, and from 2 to 4 ft. in length, are hermetically sealed at one end. Into each two liquids are introduced, the heavier one being poured in first, and the lighter one being poured in so as to rest upon the top of it. The upper end is then hermetically sealed. The liquids may be sulphuric acid below, with water above; or water below, with alcohol above; or a solution of sulphate of copper below, with water above; and various others may be taken. The tubes so prepared are kept in an upright position, and diffusion proceeds. At first the region of gradual transition from the one fluid to the other occupies a very short space in the length of the tube, but, as time goes on, the region of transition spreads itself. Even after years have elapsed, however, during which diffusion has been constantly going on, the liquid at top and the liquid at bottom are found to be still remaining distinct from one another. With the sulphuric acid and water tube this may be made very evident after the lapse of a year or two by inverting the tube several times so as to thoroughly mingle its contents, when it will be found to become very hot through the mixing of the sulphuric acid with the water, and at the same time the entire liquid contents, of the tube will be found to shrink very much in bulk. In like manner a tube in which water has been introduced below, and alcohol above, shows a considerable shrinkage of bulk of its total liquid contents, on the mingling of the liquids by inversion, even after they have stood in contact for a year or more, and so it is rendered manifest that the year's time has not sufficed to complete the mixing of the liquids by the process of diffusion.

Dr. Burden commenced by remarking that the season was approaching when not a few of the inhabitants of Belfast, tempted by genial sunshine and refreshing showers, would seek for a period the charms of a seaside residence, and that, consequently, the present occasion was an appropriate one for the discussion of the subject he had selected. He deplored the indifference shown by the general public to natural-history pursuits, observing that even many who were conversant with the deductions of biology were comparatively ignorant of the inductive substratum upon which that science is based, and earnestly recommended to all such persons the study of those forms of life which abound on nearly every coast. He was convinced that, if examples of a dozen of the principal types of marine organization, at different stages of growth, were carefully examined with reference to development, structure, and function, many of the current doctrines of biology would assume quite a novel aspect to the inquirer. The lecturer here read a list of twelve marine animals, exemplifying as many great groups, which, he stated, were easily procured and of moderate size, would thrive well in confinement, and whose life-histories might be readily traced. There was nothing in the task proposed so intrinsically difficult that any well educated person might not confidently undertake it with every prospect of success. The investigation might also be pursued with comfort at all seasons, now that we were enabled by means of a simple contrivance —namely, the aquarium, to keep aquatic animals alive and under observation for as long a period as was requisite beside our study table. He had no doubt but that an infinitely greater amount of really useful information would be obtained by the method of study indicated, than by the perusal of dozens of the text-books on natural history in ordinary use. The author of the paper then entered into a detailed description of the aquarium, dwelling chiefly upon its value in an educational point of view, the principles involved in its construction, and its proper management. He strongly advised those preserving marine animals alive for the purpose of scientific observation, not to feed them. In proof of the length of time during which they might be kept alive, and apparently in the enjoyment of excellent health, without an artificial supply of food, he exhibited some living specimens which he had brought with him from the seaside early in September last; also the shells and crusts of many others which had lived in his possession for periods of from six weeks to seven months. He concluded as follows:—"I cannot refrain from expressing a hope that our society may be induced to establish an aquarium within the walls of this building. I am persuaded that such a step would not only tend to popularize the study of natural history in this locality, but would also enhance in no small degree the other attractions of our museum. The expense attending the undertaking must be small, and when we remember that the experiment has already been successfully tried in many other towns, both in our own country and on the Continent, we may, I think, fairly anticipate a similar result here. [The lecturer here spoke of the enthusiasm with which the inhabitants of Brighton were promoting the construction of an aquarium in that town.] I trust, further, that the day is not far distant when many other of our public institutions will possess this instructive source of amusement. While in London last autumn I visited St. Bartholomew's Hospital, and was much pleased in finding in one of its wards a fresh-water aquarium, which bore evident signs of being carefully attended to. Its presence there, I have no doubt, distracted, in some measure, the thoughts of the poor patients from the continual contemplation of their own sufferings—a most desirable object to attain.

The paper was followed by remarks from the Rev. Dr. Macilwaine, Mr. Stewart, Mr. William Gray, Mr. Swanston, Mr. William Patterson, and the chairman, who cordially agreed with Dr. Burden as to the desirability of establishing an aquarium in this town. Mr. Stewart, however, thought that the museum was not the best place for it, and suggested that the town council might, with advantage, place one in the proposed public park. The Rev. Dr. Macilwaine thought that the Botanic Gardens would be a suitable place for a fresh-water aquarium. Dr. Burden was enabled to illustrate many parts of his paper by reference to a tastefully-arranged and well-stocked aquarium, which had been kindly lent for the occasion by one of the ladies of the Naturalists' Field Club.

LONDONDERRY NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

A MEETING of the Londonderry Natural History and Philosophical Society was held on Tuesday evening week, in the Round-room of the Corporation Hall. There was a large attendance, the general audience including not a few ladies. The business announced on the circular was the reading of papers as follows:—"Notes on Phenomena of the Glacial Epoch in the Neighbourhood of Derry," by the president; "On the Butterflies of a part of Inishowen," by Mr. W. Hart, Kilderry; "On a Cave lately discovered near Malin Head," by Mr. Dugan, and "Cases of Abnormal Arrangement of the Viscera in Human Subject," by Dr. Cuthbert. All of these were read excepting the last, which was deferred for want of time. Sketches and diagrams for the illustration of the papers by the president and Mr. Dugan were suspended on the walls of the room, and the latter gentleman's paper was further illustrated by shells and bones found in the cave at Main Head. William John Foster, Esq., T.C., exhibited specimens of the bricks of which an old house belonging to him, lately taken down, had been built, their chief interest lying in the circumstance that the house from which they had been taken was the residence of the Mayor of Derry during the famous siege. The bricks themselves were considerably smaller than those now made, and much whiter in colour. The masonry of the old house was very strong and adhesive, large portions of the walls coming down together.

The minutes of the previous meeting having been read by the secretary, Mr. Watson, and confirmed, the president, Mr. Harte, C.E., F.R.G.S.I., left the chair, and Dr. Cuthbert, the vice-president, took it.

The president then gave an exposition of the phenomena connected with the "Glacial Epoch" as manifested in the geological conformations in the neighbourhood of Derry. This was illustrated by diagrams, and by specimens in stone, brought from some distance.

The president having again taken the chair, Mr. W. Hart, Kilderry, read an admirably written and exhaustive paper on the Butterflies of Inishowen.

C. W. Dugan, Esq., A.M., District Inspector of Schools, then gave some notices of the Ancient Cave Dwellings of Inishowen.

BOSTON (U.S.) SOCIETY OF NATURAL HISTORY.

APRIL 6TH.—Mr. W. T. Brigham called the attention of the society to an island in the Pacific Ocean, lying S.E. of the Sandwich Islands, known as Brook's Island, and used as a coaling-station for steamers plying between San Francisco and Hong-kong. The speaker said the island was a part of the reef belonging to the Sandwich Islands; he described the shape of the island and the position of the two lagoons which its coral wall inclosed. The island was interesting, he said, as it shows how such islands may, by the agency of oceanic currents, become covered with a vegetation derived from lands quite remote from it. Upon the shores of the island had been found the remains of two Chinese junks, seeds of trees, and plants from the East Indies, and trunks of trees from the coasts of Oregon and California (U.S.)

The island was now covered with a shrubby vegetation derived from these drifted seeds. The speaker remarked that it would be instructive to determine what plants, and what proportion of plants from different latitudes, would grow in that climate.

Capt. N. E. Atwood exhibited a large tumour which had been taken from the abdominal cavity of a healthy haddock.

Most of the session was occupied in discussing the proposed change in the constitution and by-laws of the society, whereby, instead of the present system of one curator for each department, there shall be "a committee of three on each department of the museum, who together shall form a board for the management of the concerns of the society, and shall be called the council."

The motion for the proposed change having been announced at the two preceding meetings, was carried in the affirmative by a large majority. Another affirmative vote at the next meeting will be necessary before it can become a law.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, APRIL 18TH.—M. Dumas not being present, M. Balard opened the meeting by presenting a paper by M. Reboul, Professor in the Faculty of Science of Besançon, on the Hydriodates of Propylene; and a note by M. Croullebois, Préparateur of the College of France, on the indices of refraction of liquids, and on their variation with the temperature. By means of a very delicate optical apparatus he confirmed many of these variations. He discovers that the maximum of value of the index of water corresponds with the temperature of the maximum of density.

M. Boussingault presented a work by M. Musculus, Military Pharmacien at Constantine, on the constitution of starch granules, in which he states that starch treated by acetic acid affords a dextrine insoluble at a temperature of 50°, which becomes soluble by cooling, and regains its former state of insolubility upon being again submitted to the before-mentioned temperature.

M. Combes brought forward some new experiments by M. Hirn, this time following the method of MM. Pflanndler and Blutter, that of mixtures; the results were the same as in the first experiments; there has been no irregularity in the increase of the value of the specific heat of water, with the temperature about that of the maximum of density.

M. Delaunay then gave some communications taken from divers letters containing some new details on the Aurora borealis of the 5th of April, seen in a great many different places. M. Sonrel has also collected a good deal of information with reference to this phenomenon.

Another note brought forward by M. Delaunay was one by M. Rayet, announcing that on Tuesday, April 12, whilst making spectrum analyses of the sun, he perceived, as already described by Father Secchi, the transformation of the band C into a luminous band.

A third paper presented by M. Delaunay, of which M. Georges Quesneville is the author, tending to show that M. Flammarion was mistaken in the calculations by means of which he thought to signalize a numerical relation between the time of rotation of the planets and their density. M. Delaunay had not verified the calculations of M. Flammarion, nor those of M. G. Quesneville, therefore he could affirm nothing either for or against the reality of the relation indicated by the former or contested by the latter.

M. Dumas then brought forward some papers, one mentioning some facts relative to icicles on the surface of dead plants which had been evidently produced by the ascension of water through some of the roots still living.

A note by M. Noiret relative to the purification of the atmosphere of hospitals advises the use of a very simple and inexpensive process, which consists in passing the air through spongy masses, saturated with perchloride of iron.

A note by M. Pratt on gold and its composition; a paper by M. Blondlat on black phosphorus; by M. Joly on the rotation of the embryo in Axolotls after fecundation; and a note from M. Béchamp on the formation of urea by the action of permanganate of potass on albumenoid substances, were also presented.

THE VIENNA ACADEMY.

VIENNA, MARCH 10TH.—The president announced the death of Prof. Redtenbacher, which occurred on March the 5th.

The directors of the State telegraphs informed the Academy, in a letter bearing date February 21st, that the Handelsministerium had arranged with the Finanzministerium to allow telegrams on the discovery of new telescopic comets sent from the Academy to the observatories at Cracow and Kremsmünster until the end of May, 1872, to be transmitted as free telegrams, and that the telegraph directors were commissioned to take the necessary steps to obtain the same privilege for the communication of these discoveries to Altona, Berlin, Leipsic, and Carlsruhe.

Herr Hofrath and Prof. Hyrtl presented a memoir on the pelvis of the kidney of mammalian animals and man. It contains a detailed description of the urinary organs (ureters, pelvis, calyces, and papillæ) of three genera of Cetacea, two of Monotremata, three of Marsupialia, two of Solidungula, six of Ruminantia, twelve of Carnivora, four of Insectivora and Cheiroptera, and five of Quadrumana. The section of the memoir treating of the human kidney is a very elaborate one.

Herr Karl Fritsche sent in a paper entitled, "Phænological Studies." The author has observed that the times of blossoming and fruit-ripening in plants, as well as of the earliest and latest appearance of periodically occurring animals, will correspond closely year after year, even for many years, whilst at another they are not unfrequently widely different, although the respective species of plants or animals are the same at both stations.

Prof. E. Mach presented a memoir by Herr V. Dvorák, entitled, "On the After Impressions of Excitant Changes."

Herr H. Rath sent in a paper entitled "The Rational Triangle."

Prof. E. Neimtschik sent in a paper on simple constructions of oblique hyperboloids and paraboloids with their shadow outlines.

Herr C. Puschl, capitular of the Benedictine House at Seitenstetten, sent in a paper on a cosmical attraction which the sun exercises through its rays. The author finds by computation from certain data that the sun exerts through the ether waves issuing from it an attraction on opaque bodies which equals the repulsion which, according to the emanation hypothesis, it must exercise through the material particles emitted by it.

Herr J. Sollinger presented a memoir on the atomic heat of nitrogen in its solid combinations.

Dr. J. Skoda presented a paper on the effect of Digitalis and Tinctura Veratri viridis on the temperature in croupous pneumonia, by Dr. Leopold von Schrötter.

Prof. V. von Lang made a communication on a new method of investigating the diffusion of gases through porous septa. The apparatus employed consists of a porous cell, such as is used in a Bunsen's element, which is connected by a thin caoutchouc tube with the air-tube of a Marriotte's bottle. The air-tube is so arranged that its lower end is on a level with the opening of the outflow tube, so that the gas in the porous cell is always at the pressure of the atmosphere. As soon as an increase occurs in the volume of the gas in the cell, it passes through the caoutchouc tube and accumulates in the upper part of the bottle, displacing an equal volume of water, which can easily be estimated by weighing it. By a slight modification the apparatus can be used in the case of a diminution in volume.

Dr. Reuss presented the fourth part of Dr. Manzoni's *Italian Fossil Bryozoa*. It contains the description of twenty-four species of chilostomous bryozoa, of which two belong to each of the genera Salicornaria, Hippothoa, and Escharа; one to each of the genera Lepralia, Retepora, Lunulites, and Cupularia; six to the family Cellepora; and, lastly, eight to the Membranipora. Nine of them are quite new. The species described occurred partly in the Pliocene of Calabria and Castellarquato, partly in the Miocene of Turin and other places. At the conclusion of the paper the author is led to notice three species of cyclostomous bryozoa, and through this to comment on the general zoological value of many genera founded only on the different arrangement of the tube-cells.

Professor Suess presented the second part of his researches on Ammonites, and treats of the structure of the spiral shell. The author first refers to Carpenter's observations on the minute structure of the shell. He then examines the relations of the shell to the animal. A glance at the shelled cephalopods shows that the older forms occupied one chamber in particular, which inclosed the entire animal, and formed its real habitation, whilst many of the later-formed chambers were only attached to the hinder extremity of the body by muscular ligaments, and formed only a hydrostatic apparatus for the more ready movement of the animal in the sea. It is also evident that the shell which is present, provided with rudimentary shell-muscles, as a rudimentary ammonite-shell in the female of the living genus Argonauta, may be regarded as an ostracum without the nacreous layer; and that Argonauta belongs to a great family which begins with Tracheceras, and includes Cosmoceras, Toxoceras, Crioceras, many scaphites and the flexuosi.

Professor Brücke stated some results of his investigations on the products of the digestion of albuminous substances. He has examined the precipitates produced in their solutions by metatungstic acid, by phospho-molybdic acid, and by iodide of mercury and potassium. He has found among them two bodies which have the same series of reactions as each other, but of which one is soluble and the other insoluble in alcohol.

Professor Loschmidt presented a paper on experimental researches on the diffusion of gases without porous septa. The object of these

investigations is the determination of the so-called diffusion-constant—that is, the velocity with which two gases mix together when they are placed in free contact with each other on a horizontal plane. The present research is on the combinations, air—carbonic acid, carbonic acid—hydrogen, and hydrogen—oxygen. The principal result is the law of the proportionality of the diffusion-constants with the squares of the absolute temperatures.

Dr. G. Neumayer presented a paper entitled "A Project for Preparations for the Transit of Venus in 1874."

Professor E. Ludwig gave an account of an investigation carried out by himself and Dr. C. Graebe on some naphthaline derivatives related to the kinones.

Martins and Griess have described three substances obtained from biamido-naphtol of the composition—

$C_{10}H_8N_2O$ biimidonaphtol,
$C_{10}H_7NO_2$ oximidonaphtol,
$C_{10}H_6\ O_3$ oxynaphtochinon,

the last of which has been stated to be an isomer of alizarin. These bodies exhibit a constitution analogous to the kinones, in the two first of which the imide group plays a part corresponding to that of the oxygen of kinone, and are changed by nascent hydrogen into three others of the following composition:—

$C_{10}H_{10}N_2O$ biamidonaphtol,
$C_{10}H_9NO_2$ oxyamidonaphtol,
$C_{10}H_8\ O_3$ trioxynaphthalin.

The relations of these six compounds to one another, and to kinone and oxykinone, are shown by the following scheme:—

$C_6H_4\{^{OH}_{OH}$	$C_6H_4\{^{O}_{O}>$
Hydrokinone	Kinone
$C_{10}H_5(OH)\{^{NH_2}_{NH_2}$	$C_{10}H_5(OH)\{^{HN}_{HN}>$
Biamidonaphtol	Biimidonaphtol
$C_{10}H_5(OH)\{^{NH_2}_{OH}$	$C_{10}H_5(OH)\{^{HN}_{O}>$
Oxyamidonaphtol	Oximidonaphtol
$C_{10}H_5(OH)\{^{OH}_{OH}$	$C_{10}H_5(OH)\{^{O}_{O}>$
Trioxynaphthalin	Oxynaphtokinone

NOTES AND MEMORANDA.

The North German Ocean Observatory last year concluded an important examination of the courses followed by steamships between the Lizard and New York, to discover by what route a steamship can accomplish the distance between the two points in question, at various seasons of the year, in the shortest time.

At the Annual Meeting of the Palæontographical Society it was reported that new monographs by Mr. Carruthers on the Fossil Cycadeæ, by Dr. Lycett on the Fossil Trigoniæ, and by Prof. Owen on the Purbeck Mammalia, were in preparation; that Mr. H. Woodward would continue the monograph on the Trilobites, left unfinished through the death of Mr. Salter; and that Mr. Wood would issue a supplement to the Crag Mollusca.

SCIENTIFIC DIARY.

WEDNESDAY, April 27th.

London Institution, noon. Anniversary Meeting.
Society of Arts, 8 p.m. "A Narrative of the Works of the Suez Canal," by Daniel Adolphus Lange, Esq.
Belfast Natural History and Philosophical Society, 8 p.m. "On Animal Life at great Depths in the Sea," by Dr. Wyville Thomson, F.R.S.
Geological Society, 8 p.m. "Species of Rhinoceros found in Fissure-Caverns, Preston, 1816," by Mr. G. Busk. "Two Gneissoid Series in Nova Scotia and New Brunswick," by Mr. H. Y. Hind. "Notes on the Geology of Arisaig, Nova Scotia," by Rev. D. Honeyman.
Archæological Association, 8 p.m. "Recent Discoveries at Newbury," by Dr. Silas Palmer.
Society of Literature, 8.30 p.m. "Literature," by Sir P. Colquhoun, LL.D.

THURSDAY, 28th.

Royal Society, 8.30 p.m. "On the Organs of Vision in the Common Mole," by Dr. R. J. Lee. "On an Aplanatic Searcher applied to Microscopes, and its Effects in Increasing Power and Improving Definition," by Dr. G. Royston-Pigott. "On a Cause of Error in Electroscopic Experiments," by Sir Charles Wheatstone, F.R.S.
London Institution, 7.30 p.m.
Royal Society Club, 6 p.m.
Royal Institution, 3 p.m. "Electricity," by Professor Tyndall.
Zoological Society, 8.30 p.m. "Notes on a North American Batrachian (*Spelerpes rubra*)," by Mr. St. George Mivart. "Notes on some Points in the Anatomy of certain Kingfishers," by Dr. Cunningham. "On a new gigantic Amphibian, allied to Lepidosiren, from Queensland," by Mr. G. Krefft, C.M.Z.S.

FRIDAY, 29th.

Royal Institution, 8 p.m. "Interpretation of Popular Myths," by Prof. Blackie.

SATURDAY, 30th.

Royal Institution, 3 p.m. "Astronomy of Comets," by Prof. Grant.

MONDAY, May 2nd.

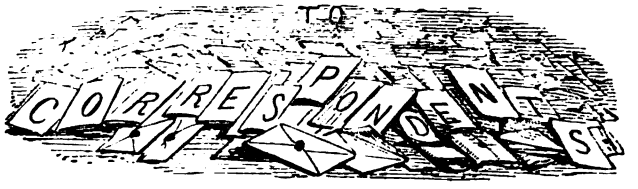
Victoria Institute, 8 p.m. "On Comparative Psychology," by C. J. Morshead, Esq.
Entomological Society, 7 p.m.
Medical Society of London, 8 p.m.
Asiatic Society, 3 p.m.
London Institution, 4 p.m.
Royal Institution, 2 p.m. Annual Meeting.

TUESDAY, 3rd.

Anthropological Society, 8 p.m. "The Aboriginal Tribes of the Nilgiri Hills," by Major Ross-King. "The Armenians of Southern India," by Dr. John Shortt. "The Kajahs of Southern India," by Dr. John Shortt.
Institution of Civil Engineers, 8 p.m.
Pathological Society, 8 p.m.
Syro-Egyptian Society, 7.30 p.m.
Royal Institution, 3 p.m. "Moral Philosophy," by Prof. Blackie.
Leeds Philosophical and Literary Society, 7 p.m.

WEDNESDAY, 4th.

Society of Arts, 8 p.m.
Obstetrical Society, 8 p.m.



NOMENCLATURE OF ROCKS.—"J. H. K."—We thank you. The MS. has arrived, and appears. Send the other paper, and if suitable it shall appear in serial form. It would probably constitute two or three parts. Send us any notes of news in your part of the world, and accept best wishes.

FIRING UNDER WATER.—"O. H. S."—Thanks. Blocks received. The paper shall appear. We shall be glad to forward your views to the best of our power.

DEEP SEA DREDGING.—"M. H."—The note appears. Always glad to do what we can for you.

DUST AND DISEASE.—Our correspondent should have sent us his real name. We quite agree with him. He will see that his wish was anticipated. We shall return to the subject before long.

REVIEWS OF FOREIGN BOOKS.—"W. S. M." is heartily thanked. We have, in compliance with his desire, published the matters sent at some inconvenience. Glad of further aid in this direction.

SULPHUR SOLUTION.—"Ignoramus."—We quite sympathise with the views of our correspondent, but there is some probability that his letter, if published, might reflect on some special manufacturers, and might be deemed libellous. Under these circumstances we must decline to insert it.

AUSTRALIAN HIEROGLYPHICS.—Our correspondent will greatly oblige by sending us the blocks he refers to. The subject is of the highest interest. Has our correspondent read Mr. Taylor's recent work on New Zealand? He would find therein much to interest him.

PROCEEDINGS OF THE FRENCH ACADEMY.—"F." is labouring under some misapprehension. Much as we esteem the reports of the Académie des Sciences in the *Libérte* and *Débats*, we must confess to thinking that the "Cold *Comptes Rendus*" are better adapted to our requirements. Nevertheless, we are obliged to him for his trouble.

THE HERRING FISHERY.—M. Soubeiran is thanked for his paper. Has he read Dr. Lawson's articles "On Herrings and Herring Fishing" in the *Popular Science Review* of two or three years since?

INTERNATIONAL EXHIBITIONS.—Lieut.-Col. Scott's communications are to hand.

UNIVERSITY PRESS.—"G. R."—We are obliged to you for your trouble. We hope your demand will be successful.

BRITISH RAINFALL.—"G. J. S."—Thanks. Blocks received and used. The magazine to hand, and shall be noticed.

SPECIES OF MEGALICHTHYS.—"J. W."—We shall do our utmost to oblige you in the matter. If the paper is not too long, it shall be reproduced.

WEDNESDAY, MAY 4, 1870.

THE ROYAL SOCIETY OF MEDICINE.

THE members of the medical world are to be congratulated on their efforts to establish a central society in the stead of the multitude of small associations which now exist. But what shall we say of those who constitute the world of Science, and who, with a greater necessity for a central Academy, still divide themselves among a legion of "bodies" which are really incapable of maintaining a satisfactory independent existence? Long enough ago—almost before the Royal Society of Medicine was contemplated—we urged on the Fellows of the several Scientific Associations of London to consider the propriety of amalgamation. In support of this proposal, we urged what appeared to us to be points of decided importance. We indicated the more striking defects of the existing condition of disorganization—the absence of requisite funds, the confusing nature of a crowd of similar publications, the loss of time sustained in attending various societies, the impossibility of founding a useful library or museum, and last, but not least, the wasteful expenditure of money involved in the maintenance of numerous public buildings when one might be made to suffice for all. But though we laid these facts fully before the scientific public, we are compelled to the somewhat discreditable admission that in a matter of pure reason the medical profession has taken the lead of scientific men, and has almost accomplished for a section of the community the scheme thrown out by us for the scientific world, but which the *savants* have not yet deemed worthy of consideration.

We have before us now the scheme of the committee of delegates appointed by the different medical societies of the metropolis to establish a Royal Society of Medicine, which should thus amalgamate all the medical associations without destroying the independence of the several departments which they represent. While in some of its details this plan presents features which require and will probably receive modification, we are bound to say that as a whole it admirably meets the requirements of the occasion. It is well considered and carefully worded, and, so far as we can judge, if it be carried out substantively, it will at once increase largely the influence of the medical profession as a section of the public, and will give a status to the scientific labours of medical men such as they never acquired before.

In its general character it is remarkable how closely this scheme for the fusion of the medical societies resembles that we long since projected for the amalgamation of the scientific associations. According to it, the new Society will consist of a central representative body, containing the following seven separate sections:—Medicine, Surgery, Obstetrics, Pathology, Psychology, Clinical Medicine, and, lastly, a section of Epidemiology, Hygiene, and Medical Jurisprudence. It may appear strange that certain other departments which will naturally occur to the reader have been omitted. But this omission is provided for by the determination of the Society to entertain questions of Therapeutics, Chemistry, and Physics in each section, so far as they bear on the special subject under consideration. The government of the Society will be in the hands of a general council, composed of representatives of the sections, and besides the president and officers of the society itself, each section will have its distinct chairman, treasurers, and secretary. There is only one defect in the general outline to which we think it desirable to draw attention, and that is the arrangement by which professional men may belong to any of the sections without being really Fellows of the Society. This is a kind of peicemeal plan, that seems on its face anomalous, and that can, in our opinion, be productive of no advantage commensurate with the difficulties it must involve. We can only trust that it is to be maintained but for a short time, and that its object is to prevent certain individuals from obtaining a position—which by joining the smaller societies they would now effect—to which their professional claims do not entitle them. In all other respects the scheme is an excellent one.

Our chief object, however, in noticing a movement which only distantly relates to the scientific world is to show how much may be done in even a brief time by a little energy and co-operation. That which the medical societies have done is that which we proposed that the scientific bodies should do, and which these latter might easily have succeeded in accomplishing if a few of those in authority had put their shoulders to the wheel, and had made an effort in what we cannot but think is, after all, the right direction.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

WE hear with much pleasure of Mr. Ernest Hart's return to London, and of his probable future connection with the *British Medical Journal*. Till Mr. Hart took up the reins of the *Medical Journal* it was a paper little esteemed by the profession. With a combination of skill and energy not usually found, he made that paper the successful rival of the *Lancet*; and we doubt not that once again in his hands it would redeem some, at least, of the position it has certainly lost during the past year.

"FORCE *versus* Organization" is the title of a series of able papers which are going through a local journal of much merit, *St. Cuthbert's Magazine*. They are published anonymously.

IN commemoration of the centenary of the discovery of Australia, a grand Metropolitan International Exhibition will be held in the Prince Alfred Park, Sydney, in August and September next, when medals and prizes will be given for exhibits in several departments.

A CATALOGUE of the Botanical Museum at Leyden is being brought out under the direction of Mr. F. A. Miquel. The first part, according to the *Athenæum*, is the Flora Japonica.

WESTERN SCOTLAND, says the *Lancet*, is proud of her ancient seat of learning, as may be inferred from the hearty support which the preparations for the new buildings are receiving. Government, it will be remembered, voted a sum of £120,000 for their construction, on condition that a similar amount was raised by the public. The latter have contributed £127,000; while the additional sums of £100,000 have been obtained for the old buildings from the Union Railway Company, and £17,500 from what is called the Fabric Fund of the University. The original estimate of £360,000 has therefore been more than realized; but it is found to be under the mark, and, accordingly, efforts are being made to subscribe the deficit. Last week a deputation, consisting of Principal Barclay, Professors Caird and Allen Thomson, and J. A. Campbell, Esq., had an interview with the Lord Provost and leading citizens of Greenock, at which it was agreed to appoint a committee for the collection of subscriptions in aid of the building fund.

THE report of the conferences of the India Committee of the Society of Arts on "A Gold Currency for India" has been reprinted, and may be had of the Society's publishers, Messrs. Bell & Daldy, price 1s.

Their Royal Highnesses the Prince of Wales, President of the Society, and the Princess of Wales, have graciously signified their intention of honouring with their presence the Society of Arts Conversazione at South Kensington Museum on the 4th of May. The Council have every confidence that the members of the Society will aid them, by all means in their power, in protecting their distinguished guests from that crowding which unfortunately is but too common in public places in England, and in securing to them that freedom of movement among the various objects of interest which is accorded to the guests generally. We sincerely trust the Society's confidence may not be misplaced.

The subscriptions to the fund for defraying the costs of the projected inquiry upon sewage utilization by a committee of the British Association amount now to upwards of £1,200, and we are glad to learn that the committee will begin their investigation forthwith.

We learn from the *Gardeners' Chronicle* that the fine collection of plants formed by the late M. Victor van den Hecke de Lambeke, of Ghent, whose death we recently announced, was sold by auction on Monday and Tuesday last, under the direction of M. Jean Verschaffelt.

At a meeting of the Royal Medical and Chirurgical Society yesterday week, Dr. Broadbent exhibited a sphygmograph which he had devised. The instrument is so contrived that it can be applied to the radial artery while the arm is in the semi-prone position; thus obviating the necessity of a forced maintenance of supination of the limb.

A large number of prizes for investigations in physical science are offered by the Dutch Society of Experimental Science. Particulars may be had by applying to the secretary, Dr. Van der Pant, of Rotterdam.

The Royal Horticultural Society has published, in the form of a small pamphlet, Mr. Badger's Prize Essay on Cottage Gardening, and that of Mr. H. Buttery on Window Gardening. These essays may be obtained at a cheap rate for distribution among cottagers on application to James Richards, Esq., assistant secretary, Royal Horticultural Society, South Kensington, W. The prizes were offered by Mr. W. Egerton Hubbard, and were keenly contested for.

The manufacture of the Falmouth, Gibraltar, and Malta Telegraph Company's cable was completed on the 8th ult. The laying operations are to be commenced at the Malta end of the route, and are so timed that the Bay of Biscay may be reached during the fine weather which may be expected about the middle of this month. The work of submersion is to be completed by the 31st.

The *Artizan* states that Dr. Ott has published a memoir on timber-preserving processes. He says the opinion that carbolic acid and substances containing it are effectual in preserving timber is erroneous. The real preservative action of the tar oils is due, according to the author, to a greenish fluorescent oil that comes over at the last stage of distillation. Direct trials with pyrene and paranaphthaline do not yield successful results. The question whether coal-tar contains a sufficient quantity of the fluorescent greenish oil just alluded to, to justify the use of such tar for preservative purposes, is answered in the negative. The decay of timber, or peculiar transformation which makes it unfit for practical purposes, seems to be in most instances produced by the attacks of fungi and lichens. The mouldering of wood is distinct from decay, it being merely a chemical process caused by the action of water with small access of air.

The number of the *Indian Medical Gazette* which has just reached us contains the following extract from the Report of the Agri-Horticultural Society of the Punjab on Sunflowers (*Helianthus annuus*):—An annual plant. Its seed has an edible kernel, and affords 15 per cent. of a mild oil, which is equally good for food or for burning. If the outer skin is removed it would give a still larger proportion of oil. Although little cultivated as an oil-seed it deserves to be better known, especially as its seed is very useful for nourishing and fattening poultry. It is said to increase the number of eggs. The roasted kernels are used instead of coffee. The foliage, which is abundant, and may be partially removed without injury to the seeds, forms a good fodder for cows. The stems, which will do for sticks for peas or beans, may be burnt, and their ashes abound in potash. Sunflowers require good and fertile soil if they are to produce much seed, but they will succeed in very indifferent soil, or even in very moist ground. Their cultivation is very similar to that of Indian corn. They may be sown from April to May in lines or broadcast. It has often been said that large plantations of sunflowers are useful in marshes or places where malarious fever is common, as this plant is a decided remover of malaria.

On Thursday week the professors of the Paris School of Medicine met in order to elect the first occupant of the new Chair of History and Philosophy of Medicine. The candidates, says the correspondent of the *Lancet*, were three in number—M. Daremberg, the author of several works on medical history and criticism; M. Bouchut, physician to the Hôpital des Enfants Malades; and M. Lorain, physician to the Hôpital St. Antoine. After three successive votings, the name of M. Daremberg was placed on the first line, and that of M. Lorain on the second, M. Bouchut following third. On Thursday last a similar election took place to the vacant chair of General Pathology.

The following interesting report, detailing the sea-going powers of the *Monarch*, is given by Captain Macomb, of the United States ship-of-war *Plymouth*, which escorted the *Monarch* across the Atlantic, to the Hon. G. M. Robeson, Secretary of the Navy, giving his opinion of that vessel:—"Her motions, rolling or pitching, are so slight that I think there would be but rarely an occasion when the height of sea would prevent her from fighting her guns. Her accommodations are very great—cabins, ward-room, steerage, and berth-deck being large, light, and well ventilated, and not requiring artificial ventilation. Under all circumstances, during the voyage she has proved herself a capital 'sea-boat,' and capable of steaming or sailing round the world unattended or unescorted. Altogether I consider the *Monarch* the most formidable and effective ironclad vessel-of-war for ocean service in the world. I omitted to mention that under sail alone she sails and steers uncommonly well for so large a ship."

The third course of Cantor Lectures of the Society of Arts for the present session is by Professor A. W. Williamson, F.R.S. The course consists of four lectures on "Fermentation." The first was delivered on Monday evening, the 25th of April; the second on the 2nd inst. The others will be given on the 9th and 16th of May, at eight o'clock. Lecture II. was devoted to Cyclical action analyzed: 1, in known cases; 2, in less known cases; theory of "contagiousness" of chemical action; composition of yeast, and changes which it undergoes; assimilation of food by yeast plants during life; decomposition of yeast plants during life. Lecture III., Monday, May 9, will be upon Propagation of ferments; prevention of fermentation; Germs in air—how removed, how destroyed; processes for arresting fermentation. Lecture IV., Monday, May 16.—Wine-making and wine-keeping; chemical changes which improve the quality of wine; chemical changes which deteriorate the quality of wine. These lectures are open to members, each of whom has the privilege of introducing two friends to each lecture.

Sad intelligence has been published as respecting the effects of the Red Sea heat experienced in the Suez route. One Sunderland steamer has arrived out in Calcutta with every stoker dead; several others have suffered severely, and nearly

all that have passed through tell the same dismal story of distress. Is it, then, says a contemporary, "that the heat in the land-locked waters of Egypt and Arabia is increasing? Or are the dust-laden siroccos and dreaded calms more fatal now than of old?"

THE students at Surgeons' Hall, Edinburgh, have just presented a splendid case of amputating instruments, with a highly flattering address, to Dr. Alexander Sinclair, who has for two years held the position of Demonstrator of Anatomy at the Hall, and is now about to leave for England.

WE are not responsible for the following statement, which we merely quote from the press:—It appears that we are in a fair way to lose about 3,000 square miles of British territory. In a report on the vegetation of the Andaman Islands, Mr. Kurz, Curator of the Herbarium of the Calcutta Botanical Gardens, gives it as his opinion that these islands are in a sinking state, and must eventually disappear. Mr. Kurz has arrived at this conclusion from having observed, at various points of the islands, a vast extent of decaying vegetation, stumps of trees, &c., covered by or open to the action of the sea. There are upwards of 6,000 convicts on these islands; but there is no occasion for immediate anxiety on their behalf, for, according to Mr. Kurz, the submersion is proceeding only at the rate of 1 ft. in a hundred years, and it will take a thousand years before all the stores and houses along the beach at Ross Island disappear under water.

M. HENRI CLAUDET, of Regent-street, has introduced a photographic novelty which possesses more than one recommendation to public notice and approval. By the new plan photographs are embossed or raised after a fashion which has been found to aid considerably in the effect of a lifelike roundness; and, combined with this convexity of surface, which of itself is not new, a system of enamelling the picture is adopted, so as to give it a firmness and rigidity which will resist any moderate pressure. At the same time the smoothness and gloss have a very pleasing sightliness; and the delicacy of the texture lends itself remarkably well to the operation of tinting. Some of the portraits that have already been taken by M. Claudet after this method are admirable specimens of photographic art.

WITH respect to the increased and growing demand for iron for foreign railways, it is stated that Norway and Sweden have under consideration the construction of about 1,200 miles of narrow-gauge lines, like the Festiniog Railway. We learn, also, that over 3,000 versts of cheap narrow-gauge lines are about to be constructed in Russia and Germany, and considerable additions are to be made as auxiliaries to the main lines. Summarizing the railway undertakings in course of execution and projected for completion within the next few years, a total is arrived at of some 50,000 miles of railway, or nearly half as much as existed throughout the world at the end of 1868, viz., 109,000 miles. This fresh construction added to the yearly renewal of 109,000 miles, besides increase of sidings, aided by the reduction of import duties in the United States, promises a demand for iron—such, indeed, as we have never yet experienced, even in proportion to our greater power of production. The Board of Trade returns show that there were 151,437 tons of iron, pig and puddled, exported in the last quarter, as compared with 122,667 last year. Of bars, angle, and rod-iron 71,023 tons, as compared with 84,050 last year. Of all sorts of railroad iron 209,151 tons, as compared with 148,206 last year. Altogether, there were 551,357 tons of iron and unwrought steel exported the last quarter, of the value of £4,240,458, as compared with 468,835 tons in 1869, of the value of £3,595,781, the value of that exported in 1868 being £2,924,034.

AN Act has been passed in New York requiring that fire-escapes should be affixed to houses used for residential purposes. 11,000 houses have already been furnished with escapes. The superintendent of buildings in the American city recommends that there should be a special doorway marked "Fire-escape" constructed in the party wall of adjoining houses. We apprehend that there would be some difficulty in constructing fire-escapes in the party walls of London houses, but there might well be a regulation requiring the provision of fire-escapes. When a fire occurs in a private house, it is generally in the night, and the time which must elapse before an escape can be brought to the burning tenement, added to the time required by the inmates to recover their wits on being suddenly aroused from sleep, represents a period too long for safety. It would be possible to construct a useful rope fire-escape which might be contained in the sill case of a front bedroom or landing-stage window, and the lower end of which might be thrown into the street by simply overturning the top of the sill. It is greatly to be desired that the provisions of some sufficient and simple apparatus could be enforced by law.

A NEW evening class has just been started at the City of London College—in Natural Philosophy, by the Rev. G. T. P. Streeter, B.A. The coffee-room lately established seems to be much appreciated by the students, and efforts are being made to raise £100 in order to replenish the shelves of the library.

THE Irish correspondent of the *Observer* makes the following observations in connection with the proposed changes in the constitution of the University of Dublin:—The graduates of Trinity College are more logical, but not quite so liberal, as the Provost and Board of Senior Fellows, for they have been holding a meeting to denounce the throwing open of the Fellowships and Foundation Scholarships to Roman Catholics and Dissenters. They say the University is a Protestant institution, just as much as Oscott is a Roman Catholic one, and, as they would not be allowed to take office in that seminary, neither should Roman Catholics be admitted to the emoluments *ab initio* designed for the encouragement of Protestants. They turn round and say to the Roman Catholics—We are willing to educate you, and that is a greater favour than you would accord us.

THE Council of the International Decimal Association will hold a conference on international coinage, the introduction of metric weights and measures, and the abolition of troy weights, on Friday next, May 6th, at eight o'clock, in the rooms of the Society of Arts, Earl Fortescue in the chair. The Right Hon. Sir Charles Adderley, M.P.; J. B. Smith, M.P.; Sir Thomas Bazley, M.P.; Edward Baines, M.P.; C. R. Graves, M.P.; Dr. Farr, F.R.S.; Sir John Bowring, F.R.S.; Samuel Brown, President of the Institute of Actuaries; Frederick Hendriks, James Yates, F.R.S., Professor Leone Levi, and others, will take part in the proceedings. Members of the Society of Arts and others will be admitted on presentation of their cards.

A CONTEMPORARY proposes that the London University should be constituted on the plan of the older universities, and should have colleges, halls, and a professorial staff. It speaks somewhat ignorantly of the "Colleges of which the University consists," and offers no very satisfactory reason for a change which would completely deprive the University of its best characteristic.

AT the meeting (March 9) of the Microscopical Section of the Boston (U.S.) Natural History Society, Mr. C. Stodder exhibited a new objective of unique construction made by Tolles. With its draw-tube closed it was a 3-inch; when fully drawn out, a 4-inch; it had a working distance of only $1\frac{1}{4}$ in. He also remarked that Professor Eulenstein had written him that Nobert and himself had resolved the seventeenth band of Nobert's test-plate with a $\frac{1}{6}$-inch objective made by Tolles; they had been unable to do so with any other objective.

APROPOS of the University of London we read in the *Lancet* with much regret that representatives of the Press are to be refused admission to the new buildings on the opening ceremony of May 11th. "Had the refusal come from any of the older

seats of learning, we could have understood it, and put it down to their reluctance to encourage any innovation. But the University of London has always set her face against exclusiveness of any kind, and certainly appears inconsistent with her better self in refusing to admit, on an occasion of public ceremony, the representatives of an institution to which in great measure she owes her foundation." We quite concur in the opinion of our contemporary.

The next International Congress of Prehistoric Archæology will be held at Bologna in October. The committee propose the following questions for study and discussion at this fifth session:—1. The Stone Period in Italy; 2. The Caverns of the Shores of the Mediterranean, and especially of Tuscany, as compared with the Grottoes of the South of France; 3. The Lacustral Dwellings and the *Torbiere* of the North of Italy; 4. The Chronology of the Substitution of Iron for Bronze; 5. The analogy between the Terramare and the Kjoekken Moeddings; 6. Various Craniological Questions relating to the different Races which have peopled the different parts of Italy. Any members desirous of reading any papers to the Congress are requested to inform the secretary of their intention before the 20th of August, in order that the detailed programme of the proceedings may be completed before the opening of the Congress. The committee will be glad to receive any objects likely to throw light on the matters to be discussed; and, if the specimens cannot be sent as originals, copies or drawings of them would be very useful. The committee trust to be able to obtain a reduction in the fares of the different railway lines, so that on presentation of a member's ticket the holder will only have to pay half the ordinary fare. Those who may be desirous of joining the Congress are requested to send their subscription and name and address either to the treasurer, Count A. Guidella, President of the Chamber of Commerce at Bologna; or to Professor Michelangelo Pinto, Italian Consul at St. Petersburg, for Russia; or, for Denmark and Sweden, to Count O. Prampero, Secretary of the Italian Legation at Copenhagen.

Messrs. Longmans announce a new series of text-books in science, adapted for the use of artisans and of students in public and other schools, in small 8vo., each volume containing about 300 pages, price 3s. 6d. The following books in this series are now in the press:—*Algebra and Trigonometry*, Rev. W. N. Griffin, formerly Tutor of St. John's College, Cambridge; author of a *Treatise on Optics, &c.*; *Plane and Solid Geometry*, Rev. H. W. Watson, formerly Fellow of Trinity College, Cambridge, and late Assistant-Master at Harrow School; *Elements of Mechanism*, T. M. Goodeve, M.A., Professor of Mechanics at the Royal Military Academy, Woolwich, and Lecturer on Applied Mechanics at the Royal School of Mines; *Metals, their Properties and Treatment*, including an account of the ordinary metals, from their occurrence as ore until they pass into the workshop of the turner or fitter, by Charles Loudon Bloxam, Professor of Practical Chemistry in King's College, London.

The Central Exchange News-room, Newcastle-on-Tyne, which is one of the *chef d'œuvres* of the late Richard Grainger, Esq., is about to be rearranged as a News-room, Art Gallery, and Industrial Exhibition, and promises to become one of the chief attractions in the locality.

Aurora Borealis seen on the 5th of April last.—M. Sonrel has written a lengthy paper from which, says the *Chemical News*, we learn that this phenomenon, already alluded to by us last week, was visible over nearly all Europe, and that, wherever it was visible, the magnetic instruments were violently agitated. The author enters into a great many details on this subject, among which the most remarkable is that the Aurora was accompanied, or preceded, for a brief period, by a very disagreeable smell (the quality thereof is not specified), very perceptible, as well at Dinkelsbühl (Bavaria) as at Paris. In high northern latitudes, this phenomenon is often accompanied by a peculiar, somewhat sulphurous, and rather oppressive, smell.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

NEW, RARE, AND OBSCURE FOSSILS FROM THE NORTHUMBERLAND COAL-MEASURES.

BY T. P. BARKAS, F.G.S.

A FEW months' continuous attention to the discovery and study of the fossils of the Northumberland coal-measures enables an investigator to classify a large proportion of the ichthyolitic and reptilian remains that lie imbedded in the shale which overlies the coal in these northern parts of England; but after the most careful examination of the fossils, after collating them with specimens in the leading London and provincial museums, and after a systematic perusal of all the leading works, English and foreign, that treat upon palæozoic fauna, there yet remains a large residuum of coal-measure fossils that are either new, rare, or obscure.

I desire to direct the attention of the readers of Scientific Opinion to some fossils in my own possession that come under each of the foregoing classes.

I have now before me a fossil that is unlike anything I have previously seen, and until I had read the excellent paper by Professor Huxley on the classification of the Dinosauria, which appears in the *Quarterly Journal of the Geological Society*, February, 1870, I had not the slightest key to its interpretation. The fossil has a long, irregular, and flattened shaft, with a broadly expanded ovoidal extremity. It resembles to some extent the ischium of *Hypsilophodon Foxii*, figured in the *Q. J. G. Soc.* vol. xxvi. pl. 2, and it bears a still more striking resemblance to the ischium of an ostrich, to which bird Professor Huxley refers in tracing the analogy between the Dinosauria of the Triassic and Wealden formations and struthious birds of the present period. It is impossible to examine the excellent illustrations that are given on page 27 of the *Proceedings* referred to, and the ischium of an ostrich, without observing the relation between the fossil now to be described and the ischia of Dinosauria and of birds such as the emu and ostrich. The total length of the specimen, which I believe is the ischium of a coal-measure reptile, is $6\frac{3}{4}$ in.; the broad, expanded end is $3\frac{1}{4}$ in. long and 2 in. broad. Towards the posterior extremity and near the upper edge it is covered with deep ovoid cavities, which occasionally inosculate, and the remainder of the surface is covered with rough, reticulated grooves. The shaft of the ischium at its junction with the flattened extremity is $\frac{3}{8}$ in. broad, and at the other extremity it is $\frac{1}{4}$ in. broad; the average thickness of the shaft is $\frac{1}{6}$ in. How much longer the shaft was originally I have at present no means of ascertaining, as the specimen has been broken and the proximal end of the shaft has been lost.

I infer, by comparing the expanded part of the ischium with that of an ostrich, and the length of the shaft with the shaft of an ostrich, that the fossil was originally about double its present length. There are not any remains associated with the bone just described, and I have no means of knowing to which of the coal-measure reptiles it belonged. The markings on the expanded part of this ischium somewhat resemble those on the mandible of *Pteroplax cornuta*, and on the frontal, parietal, and supraoccipital bones of Anthracosaurus, both of which have been found in our northern coal-measures, but the reticulation is considerably finer and the depressions of more uniform size. Of *Amphisaurus amblyodus* nothing is known except the jaws and teeth, and the delicate markings on the jaws to some extent resemble those on this ischium. Of the sculpturing on the head or other bones of another large coal-measure reptile, notes on which were announced to be read before the Geological Society of London on Wednesday evening, April 13th, no information has yet been obtained. It is known to possess

upwards of eighty vertebræ; some of the ribs closely resemble those of Anthracosaurus; some of the limb-bones are tolerably well developed, but of the head, teeth, or bone sculpturing nothing is yet certainly known.

As these are all the large reptiles known to have left their remains in the Northumberland coal-measures, and as the ischium in question has not been found associated with any other bones, it is impossible to say to which of the reptiles it belongs, or whether it is part of an entirely new genus. I have also in my possession a very fine specimen of the broad distal extremity of a similar ischium. The length is 4 in. and the width 2 in. It is similarly marked, and as it was obtained from the same colliery it may have belonged to the same Ornithosaurian in Professor Huxley's new order, Ornithoscelida.

I have for some time had in my possession a very interesting bone, which at the first glance reminded me of a scapula of a reptile, and I was gratified on examining Professor Owen's paper on Megalosaurus in the *Transactions of the Palæontographical Society*, vol. 1856, table v., to find a representation of a scapula of Megalosaurus which so closely resembles that in my possession that it would serve not inappropriately as a special illustration of it. The length of the coal-measure scapula is $3\frac{3}{4}$ in., its greatest width is $1\frac{1}{2}$ in., and its general form, both on the front and side aspects, is wedge-shaped. The expanded end of the scapula is flat, comparatively thin, depressed, and nearly circular; it is deeply ridged and grooved, to afford attachments for the extremities of the muscles connected with the shoulder girdle, and in general appearance presents the aspect of a deeply-marked pecten-shell. At the base of the expanded portion there is a strong elevation, and then the extremity gradually tapers off to a wedge-like edge. It has already been stated in a previous paper that the teeth of a new reptile, which I have named *Amphisaurus amblyodus*, very closely resemble in outline form those of Megalosaurus. It is an interesting fact that they and the scapula are equally rare in our coal-measures, and it is not improbable that this scapular-bone belongs to the reptile now known as *Amphisaurus amblyodus*. The slab bearing the scapula is covered with small denticulated tubercles, resembling those that are supposed to belong to Gyracanthus and Ctenacanthus, and it is not impossible that these mitre-like tubercles, which have been named by Professor Owen *Mitrodus quadricornis*, not only belong to the Selachia of the coal period, but also to some of its reptiles.

Notwithstanding the known presence of various genera of reptiles in the Northumberland coal-shales, no well-authenticated scute of a reptile has yet been found. I have now lying side by side a scute of *Pholiderpeton scutigerum*, from the coal-fields near Bradford, and a scute, or it may be scute-like head-bone, from the Northumberland coal-measures; it is the only fossil of the form I have obtained, and, notwithstanding its remarkable resemblance to the scute of Pholiderpeton, I am not prepared to say that it is a reptile scute.

Large numbers of reptile teeth have been found in the Northumberland coal-shale, several reptile vertebræ, and many ribs and fragments of ribs. In one case fifty-six inches of consecutive reptile vertebræ with ribs, limb bones, &c., have been found, but not the semblance of a scute in association with them. Until additional evidence, therefore, has been obtained, I am disposed to recognize the apparent scute as a head-bone of some of the yet unknown coal-measure fishes.

In addition to the scales that have been described as found in our Northumberland coal strata, I have two kinds which I am unable satisfactorily to interpret; one class is slightly ovoid, approaching circular; it is $2\frac{3}{5}$ in. in its longer diameter, and $2\frac{1}{5}$ in. in its shorter. It is a very thick, strong scale, covered on the centre with deep radiating reticulations, resembling to some extent the surface-markings on the head-bones of reptiles, but more closely resembling the markings on the body-plates of a sturgeon. I am disposed to think that they are accipenseroid body-plates, and that they probably belong to the larger Ctenodi.

Fish of the genus Ctenodus are generally referred to Dipterus on the one hand, or to Cestracion on the other. To the latter class they cannot belong, as the Cestracions are true Selachians without gill-covers, and the genus Ctenodus has operculæ, strong head-bones, and well ossified ribs. The Ctenodi therefore, notwithstanding their peculiar dental armature, are true Ganoids, and are more closely related to the Accipenseroids than to the Cestracionts. It is at least probable that these strong circular bone-plates flanked the coal-measure Ctenodi, as the large plates of the sturgeon flank that cartilaginous, anodontoid, heterocercal modern fish.

The other scales or plates are smaller than those just described, the usual length being $\frac{7}{8}$ in. and the width $\frac{5}{8}$ in.; they are strong well-defined bony scales, and are surrounded on their exposed surface by a well-defined elevated rim. From the centre of the scale strong radii proceed to near the margin, and the scale presents a beautiful star-like appearance. In the event of this scale belonging to a new genus of fish, a more appropriate name could not be bestowed upon it than Asterolepis, the name originally given to a fragment which was eventually discovered to be a portion of the late Hugh Miller's well-known fish Pterichthys, which name was given by Miller, and is retained in all English works on palæontology. Should the scales to which I am now referring be really new, the transference of the name Asterolepis to the fish that possessed them from the fish now best known as Pterichthys, would only be a graceful act and a proper tribute to one of Scotland's most deserving and best loved practical geologists. In the *Annals and Magazine of Natural History* for the present month, there appears a paper entitled "Note on an undescribed Fossil Fish from the Newsham Coal-shale, near Newcastle-on-Tyne," in which paper the following positions are attempted to be established, viz., that certain large teeth, large operculæ, and large scales, which had previously been provisionally described as belonging to Rhizodus, are now in all probability the teeth, operculæ, and scales of Archichthys, and the chief arguments in favour of their being classified under a new genus are, that the teeth, unlike those of Rhizodus, are circular and not lanceolate, and that the dentary bone in which some large teeth have been found, is covered with small rough tubercles, somewhat similar to the markings on the supposed operculæ. The large teeth and supposed operculæ are those to which I referred on p. 250, vol. iii., SCIENTIFIC OPINION, on which occasion I expressed a doubt respecting the discovery of Rhizodus in the Northumberland coal-measures, and stated that the fish to which the ichthyolites belonged was yet undetermined. Notwithstanding the opinions of the writers, for whose views I desire to express all proper respect, I cannot avoid thinking that they have been too hasty in classifying the teeth, operculæ, large scales, and single jaw, as belonging to one genus. I shall briefly state my reasons for the expression of that opinion.

In the first place the large undetermined teeth in our coal-measures differ very much in form, in size and in general appearance, some being deeply furrowed at the base and others not, some being finely striated and others nearly free from striation, some being nearly circular and others flattened at the base, some being long and slender and others broad and obtuse, and one fine tooth in my possession, $1\frac{3}{4}$ in. long and $\frac{5}{8}$ in. broad at the base, assumes a lanceolate form near the apex, but in general appearance does not at all resemble the well-known flattened teeth of *Pteroplax cornuta*. I infer, from an examination of the large teeth, that they belong to at least three genera.

In the next place, the large supposed opercular plates differ considerably in form and in strength or thickness, and the largest of them are not of sufficient size to justify their being allotted to fish with teeth from 2 in. to $2\frac{1}{2}$ in. long, and strong in proportion to their length.

I have an opercular plate of Rhizodopsis, associated with a large mass of scales of the same fish, and having the characteristics of the head-bones of that fish; the operculum is 4 in. long

and 1¾ in. broad; the scales with which it is associated average an inch in length and half an inch in width, and yet the large laniary teeth of Rhizodopsis are truly insignificant when compared with those teeth that have been attributed to the supposititious Archichthys. The large scales, some of which are 6 in. in diameter, are out of all proportion to the opercular; they probably belong to a fish which possessed some of the large teeth, but with which of the large teeth they were associated it is impossible, with the means now at our command, to determine.

Besides the teeth, scales, and opercular, there are also found in our coal-shale a large variety of vertebræ with notochordal foramina of very different sizes. The largest vertebræ, with extensive notochordal spaces, are about 2 in. in diameter, and the foramina vary from 1 in. to ⅛ in. in diameter. In addition to these there are several small vertebræ with nearly solid centre, but they probably belong to reptiles. The vertebræ of Megalichthys are comparatively slender rings, and may easily be distinguished; those of Rhizodopsis are small slender rings. Other very slender ring vertebræ, about the diameter of Megalichthys, are supposed to belong to Strepsodus; they are very rare. Besides these there are three or four sizes and kinds of fish vertebræ, some of which probably belonged to the fishes which possessed the large teeth already referred to.

The question of the identification of these large teeth is as yet purely an open one, which may very speedily be determined, as scarcely a day elapses without some of the many palæontologists who are at present investigating the Northumberland coal-measures discovering some hitherto unexhumed fossil treasures. I fear we shall not satisfactorily resolve the enigma, to which fish or fishes the various teeth, vertebræ, opercular, bones, and scales belonged, until some fortunate searcher stumble upon associated fragments of those huge coal-measure inhabitants.

In addition to the jaws and teeth already described I have the anterior extremity of a large mandible which contains a large laniary tooth, and in front of, round, and behind it there are clustered a large number of bright, strong, and very small villiform teeth. The dentigerous bone is covered by very fine vermiform reticulations, which frequently inosculate and form a beautiful net-like pattern. The teeth are highly polished, black, and glistening.

I have another fragment of a mandible marked with tubercles, in which there are several straight closely-set large laniary teeth. I am unacquainted with the fishes to which these jaws belong, and, indeed, I do not know that they have been named.

Another tooth which I have long hesitated about describing is, or rather was, ⅝ in. long, but one-third of it has been destroyed in a fruitless attempt to make a transverse section for microscopic examination. In the absence of a transverse section, which would have determined its generic identity, I infer from the form, striation, and general appearance of the tooth that it belongs to some species of the genus Dendrodus, and is, I believe, the first tooth of Dendrodus that has been found in our local coal-measures.

It may be truly said of nature as was untruly said of Shakspeare's ideal of the Egyptian Queen, Cleopatra—

> "Age cannot wither her,
> Nor custom stale her infinite variety."

Since writing the foregoing I have re-read Professor Huxley's admirable address to the members of the Geological Society of London, and in the following passage there is a kind of prophetic prescience of the existence of Ornithosaurians in the older palæozoic formations. If the inferences I have drawn from the specimens in my possession be correct, the Professor's predictions have been speedily verified, and bird-like reptiles have been found to have existed during the Carboniferous period. The following is the passage to which I refer:—

"When I addressed you in 1862 I should have been bold indeed had I suggested that palæontology would before long show us the possibility of a direct transition from the type of the lizard to that of the ostrich. At the present moment we have in the Ornithoscelida the intercalary type, which proves that transition to be more than a possibility. But it is very doubtful whether any of the genera of the Ornithoscelida with which we are at present acquainted are the actual linear types by which the transition from the lizard to the bird was effected. *These are very probably still hidden from us in the older formations.*"

ANIMALS AS FELLOW-BOARDERS.

BY P. J. VAN BENEDEN.

IN THREE PARTS.—PART II.

AMONGST all the cases of companionship none are more remarkable than those of the soldier or hermit crabs, so abundant on our coasts. These creatures, as is well known, are decapod crustaceans, somewhat resembling miniature lobsters, who make their abode in deserted shells, and change both their skin and their dwelling as they increase in size. The young ones are contented with very small habitations. The shells they inhabit are derelicts they find at the bottom of the sea, and in which they conceal their weakness and personal disadvantages with obstinate persistence. These creatures have too soft an abdomen to confront the dangers they encounter in their incessant wars, and the shells in which they thrust themselves supply at once lodgings and shields. Armed thus from head to foot the soldier crab marches proudly against his enemies, and fears no danger because he has a secure retreat. But this soldier or hermit crab is not alone in his dwelling. He is not an anchorite like those dwelling in air, for by his side a worm is commonly installed as fellow-boarder with him, forming one of the most remarkable associations which is known. The companion worm is elongated like all the Nereids, and its supple undulating body is armed along its sides with bundles of lances, pikes, and daggers, the wounds from which are very dangerous. The crab, ensconced in his borrowed armour and flanked by his terrible acolyte, attacks all he finds before him and knows no reverse. Thus around his domain we observe a prosperity not seen elsewhere, and on his shell there usually flourishes a whole colony of Hydractinia blooming like a flower bed, and inside we often find Peltogaster, Lyriope, and other crustaceans, who convert it into a true pandemonium.

On the English coast is another soldier crab, who has for his principal fellow-boarder a sea-anemone, the *Adamsia palliata*. This connection is remarkable on many accounts, and especially for the good understanding which subsists between the crab and his attendant. Lieut.-Colonel Stuart Wortley has not hesitated to pry into the domestic life of these creatures, and this is what he says about them. The hermit crab never fails to offer the best morsels of his captures to his neighbour, and frequently inquires during the journey if he is hungry. But it is when the crab has to change his house that his care and attention are redoubled. He assists the anemone to move with all the address of which he is capable, and if the proposed new house does not suit him another is selected, that the Adamsia may be fully satisfied.

More than a hundred species of soldier crabs, scattered through all seas, are known, and all lead the same sort of life.

Another sort of companionship is noticed amongst crabs of the genus Dromia (Squinado), which are of moderate size, and instead of lodging in a cell dress themselves up from their early youth with a living colony of polyps, who grow with their growth. This colony has for its usual basis a live Alcy-

onium (Mermaid's Finger or Cow pap), which covers the carapace and adapts itself as it develops to the inequalities of the cephalo-thorax, so that it seems an integral portion of the crab. Sertularia and Coryne grow in abundance upon the Alcyonium, mixed with seaweeds, and the Squinado, masked by the living burden which he bears like Atlas on his shoulders, marches sedately to the capture of his prey. Concealed in the bush of a virgin forest he has no fear of attracting the attention of an enemy. There are many mysteries to bring to light concerning the inoffensive population which the Squinado carries whenever he has blood to shed. These crabs are not rare in the Mediterranean, but they are seldom seen in the North Sea.[1]

Another crab, *Hypoconcha sabulosa*, whose carapace is too tender for him to go about naked, covers himself with the shell of a bivalve mussel.

Some Crustacea of the order Amphipoda lodge in a real crystal palace, choosing for their dwelling the transparent body of a Salpa, a Bervöe, or a Pyrosoma; and in the interior of this crystalline lodging, which is often alive, he devotes himself to the pleasures of fishing. The *Phronima sedentaria* usually occupies a Salpa. These crustaceans have been met with in different seas; but one of the most remarkable examples was observed by Mrs. Toynbee (Lady Smyth) in lat. 3° 42′ S., long. 76° 19′ E., and from her beautiful drawing, which is reproduced in the superb atlas of Commodore Maury, it was a true Phronima. I may be permitted to record my admiration of Mrs. Toynbee's researches, by which she has enriched science, and of the splendid drawings she has brought home from her voyages.

We find often on our coasts the *Hyperia Latreilli* lodged in the great jelly-fish (Rhizostoma) which appears regularly in the autumn on the shores of Ostend.

The isopod crustaceans include a division of animals regularly formed and somewhat resembling wood-lice, which live on various fish—the cymathoads,—armed with strong hooks for attachment, but often, when the whim takes them, swim away from one fish and fasten on another. They are true fellow-boarders who like being carried by others better than using their own paddles. They are found in all seas, and Dr. Bleeker made us acquainted with many belonging to the Indian Ocean. On the coasts of Britain, where different species of Wrasse are common, it is rare to find one of these fish who does not lodge a couple of these crustaceans.

Besides the barnacles who live as fellow-borders on the whales, the latter give lodging on the surface of their skins to Crustaceans, who preserve their liberty, and quit one host to establish themselves on another. These are the whale-lice (Cyami), who live upon the Cetaceæ as the previously-mentioned isopods live on fish. The members of the genus Caprella usually attach themselves either to whales, or turtles, or fish, or to Sertulariæ, and appear to live under the same conditions.

The Pycnogons, whose nature and mode of life have appeared problematical up to this time, deserve to be reckoned equally amongst the fellow-borders, at least during their youth. They live, in fact, after they are hatched, on Coryne, Hydractinia, and other polyps; and it is only at a later period that they haunt mollusks and more elevated creatures.

The Mollusks of all the lower ranks show most independence, contenting themselves with the slowness of their progression and the poverty of their food, and seldom asking the aid of their neighbours.

The mode of life of the animals which have occupied our attention makes us understand the relations subsisting between certain Gasteropods and Echinoderms. The Gasteropods in question are known as belonging to the genus Stylifer, and they have been long noticed in star-fish, Asterias, Ophiura, Comatula, and even in sea-cucumbers (Holothuriæ); and as they were constantly found in the digestive cavity of these Radiates, they were supposed to be present as parasites. This opinion was first expressed by D'Orbigny, and adopted by most naturalists. They are, however, only parasites in appearance, and are really nothing more than fellow-boarders. These delicate Gasteropods have been successively ranked among the Phasianellæ, the Turritellæ, the Cerithii, the Scalariæ, and the *Rissoæ*; but Mr. Gwyn Jeffreys has just proposed, and with reason, to erect them into a distinct family. These Stylifers sometimes place themselves at the entrance of the mouth; but generally, like the Donzelle, they prefer to lodge deeper in the digestive cavity, in the midst of the food.

Quite recently, Mr. Stimpson has pointed out, in the port of Charleston, a Gasteropod Mollusk, like a Planorbis (*Cochliolepsis parasitus*), which lives as a fellow-boarder on the body of a worm, *Ocoetes lupina*. Some other Mollusks, such as *Madiolaria marmorata*, lodge as fellow-boarders in the mantle of an Ascidian, as the Magili establish themselves in the interior of Madrepores. We may also cite Vermetus, Crepidulus, and Hipponyx, which install themselves in other shells, and only ask a corner for a lodging.

The class of worms not only comprises parasites, but possesses likewise, as we shall soon see, fellow-boarders also. We find them on Mollusks, on animals of their own class, on Echinoderms, and even on Polyps. One of the most curious worms is the Myzostome, which lives on the Comatula, the true nature of which has just been revealed by the labours of Mecnikow. These Myzostomes resemble Trematode worms, but they possess symmetrical appendages covered with vibratile cilia. They run about the Echinoderms with remarkable rapidity, and have not yet been found in other situations. They are no more parasites than the preceding, but take their place beside them as free fellow-boarders.

There are many worms which live as companions in the same sheath with their congeners, and even with included Mollusks. We may cite the *Lepidonotus cirratus*, and the *Chætopterus insignis*, as well as the *Lycoris fucata*, which inserts itself in the holes of the Teredo. M. F. Müller mentions an Amphinome which establishes itself in *Lepas anatifera*. There is also a larva of a Nemertian worm (*Alardus caudatus*) which lives in the digestive-tube of a neighbour, and whose mode of life has been misunderstood. In opening the *Pylidium gyrans*, we often find in the interior of its digestive cavity a larva which was once thought to belong to it by affiliation; but the Alardus is only a fellow-boarder—at least in its young days, and at a later period can probably shift for itself.

We likewise find, commonly, a fellow-boarding Nemertian, the *Polia convoluta*, amongst the eggs and under the tail of the common crabs which belong to our coasts.

An elegant Gasteropod, the *Phyllirrhoe bucephala*, carries a singular appendage on its head, which has been long noticed by naturalists, though its nature has only lately been understood. It is the *Mnestra parasites*. Müller first took it for a Medusa, but he afterwards abandoned that opinion, when Krohn definitively arranged it amongst the Polyps, only differing from its congeners by its form, its four ciliated tentacles, and its mode of life. Thus we have a polyp as a fellow-boarder.

A superb sponge, *Euplectella aspergillum*, from the Philippines is planted in the soil, and shelters three kinds of Crustaceæ, pea-crabs, prawns, and isopods. The *Philomedusa Vogtii*, which lives on *Halecampa Fultoni*, also deserves mention.—*The Student.*

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[1] They are common on our southern coasts, and are very amusing in an aquarium.—Ed.

The Anniversary Dinner of the Victoria Institute is fixed to take place at Freemasons' Tavern on Monday, May 23rd. The Right Hon. the Earl of Shaftesbury, K.G., will take the chair, and the vice-chair will be filled by R. N. Fowler, Esq., M.P.

A NOTICE OF RECENT OBSERVATIONS ON AMŒBÆ AND MONADS BY RICHARD GREEF AND L. CIENKOWSKI.

BY HENRY E. FRIPP, M.D.

IN THREE PARTS.—PART III.

EVERY Amœba has a nucleus, and generally but one. This has no regular position, is soft, and is of an oval shape. There is—1st, a capsule or transparent membranous envelope; 2nd, a tough and thick second coat, apparently supplied with pores (that is to say, the substance is broken at intervals by radial lines); 3rd, an internal plasm, structureless and homogeneous, in which are imbedded a few strongly refracting particles. This description represents the early stage of the nucleus. At a later period the plasm becomes turbid, and in a short time there appear round granules. By degrees the whole interior is filled with them—large, distinct particles (ova) are then seen at the periphery, and in these a central transparent spot soon appears. At this stage the capsule disappears, and the matured granules or ova are scattered through the parenchyme of the body, which now contains but few of the original food and other elements. The nucleus is thus broken up and lost. The activity of the animal is now greatly diminished, and it appears to exist chiefly for the conservation and further development of the new brood. The next stage of their development consists in the growth of the ova or cells, which contain now a finely molecular plasm with a central clear spot. Soon after a large round vesicle appears by the side of the central spot. (This is the first so-called contractile vesicle.) The young Amœba, as its protoplasm increases and its vesicle enlarges, begins active movement; more vesicles appear, and finally a nucleus with distinct nucleolus is formed from the clear central mass of the early protoplasm.

The young brood has not been seen in the body of its parent after it has reached the ovum condition. The ova probably leave the parent as a mass of protoplasm, with central spot. The creature is not, therefore, viviparous. Wallich, however, observed in the *Amœba princeps*—a water species—the viviparous brood escape from the parent. Carter also describes the development of a brood from the nucleus of a water Amœba as commencing with *partition* of the nuclear substance, followed by regular segmentation.

Greef describes in one specimen of *Amœba terricola* two elongated dark outlined bodies which contained in their interior thread-like filaments. One of these bodies protruded partly from the body of the parent. He surmises them to be equivalents of the male organ of Infusoria (nuclear). A villous mass adheres to one point of the external surface of the animal. Wallich found the same in his water species, and observed that the villi or hairs are not stiff, but move like the pseudopodia of Rhizopods. He regards them as prehensile organs. Carter noticed the same appearance, but considers it inconstant, and not affording any ground for constituting a new species as Wallich does (*A. villosa* ?). Greef found the position of this villous appendage to be not always at the same end of the body, but attached indifferently to any part of the body. The villi of the land Amœba are not so extended as those of the water species, but stiff and short. He agrees with Carter in not considering this appendage to be a specific character,—because the animals which possess it do not differ in other respects from those in which it is wanting. He has watched it, also, detaching itself from the body, and thinks it to be a secretion from the ectosarc—not, however, to be viewed in the light of a cuticular formation—being stiff, and adhering as a cap-like appendage to the ectosarc. He thinks it might serve either as a point of leverage for locomotion, or as a prehensile organ to assist in taking up food.

The other species require but brief description, and may be quickly dismissed.

Amœba brevipes—rare; its small spherical body filled with a granular substance composed of darkly-glancing particles. Its sarcode, in the interior of which are vacuoles, is not differentiated, but it projects from its surface short, stumpy, transparent rays. Its movements are sluggish. It multiplies by cleaving of nucleus and body.

Amœba granifera—$\frac{1}{400}$ in. Has a creeping motion like that of water Amœbæ. Its sarcode is differentiated, the ectosarc being soft and transparent, the endosarc granular, with included nucleus and vesicle. Probably immature—the young form of some other species.

Amœba gracilis—$\frac{1}{300}$ in. Wormlike in aspect, with a villous appendage of a disk shape at one end (sucker?). The villi disposed round this disk extend or contract, and fix themselves on the glass slides (pseudopodia). In the centre of the disk-like appendage is a vacuole. It has a nucleus in its body.

Besides these species Dr. Greef found an Amœboid animal for which he proposes the name Amphizonella, and considers that it should constitute a new genus, inasmuch as, besides other peculiarities, it differs from the naked-bodied Rhizopoda in being enveloped in a thin but complete membranous covering.

The first species, *Amphizonella violacea*, is a spherical animal of about $\frac{1}{300}$ in. in diameter in its adult state. The membranous investment has a distinct outer and inner contour-line, and shows reactions when heated with Acid Acet. and Ac. Sulph. dil., which differ from those exhibited by the inner sarcode. Under pressure the capsule bursts, and through the rift a different inner mass streams out. This interior mass is deeply coloured with a dark violet pigment, with which a yellow pigment is intermixed, while the external capsule is clear and transparent. On account of the dark colour of the pigment little else of the contents is to be seen, with exception of a large nucleus $\frac{1}{600}$ in., and numerous small vescicles (vacuoles)—the nucleus being less coloured. The violet pigment is very sensitive to reagents, being immediately decomposed by acids, alkalies, iodine, &c. The inner sarcode, heated with iodine, discolours, becoming first yellow, afterwards brown black, whilst the substance of the outer capsule retains its hyaline appearance, but tinges slightly yellow after a time (by imbibition of iodine). When the inner mass has, by pressure, been squeezed out of the capsule, and rendered colourless, the foreign matter ingested can be seen (chiefly Diatomaceæ and the shells of small Arcellæ and Euglyphi). The large nucleus is soft, large, and transparent. It consists of a membrane which incloses a cavity filled with solid granules. The development of these granules is probably similar to that of those of the nucleus of the *Amœba terricola* before described. The young Amphizonella has no capsule. The movement of the animal is particularly sluggish—its change of form slow, and contraction unenergetic, consisting in slight undulations and indentations of the outer surface. The outer capsule appears not contractile, but only yields to the movement of the active plasm within. From this inner mass pseudopodia, conical or finger-shaped, are thrust forward apparently through the substance of the capsule, *penetrating* it, as it would seem, inasmuch as these processes have no double outline, so that the capsule is not pushed out in front of them. The pseudopodia can be seen making their way with conical points through the substance of the capsule, notwithstanding that the substance of the capsule powerfully resists the destructive agency of acids, alkalies, &c. The softness of its material appears in this—that it is so easily bored through and closes up again when the pseudopodia are withdrawn. They do not extend far, but sometimes when longer than usual some of the granular sarcode and coloured pigment streams into their bases. The movement of these arms is more active than that of the rest of the body.

Dr. Greef once observed two individuals coalesce by their outer capsules touching, and the substance of the capsules being fused or soldered together, but the inner sarcode of each animal remained distinct and separate; a species of union was however effected by a band of yellow hyaline substance, forming

a sort of bridge or commissure between the two masses of sarcode. Greef considers the phenomenon described as conjugation of two animals, as has been seen in other Rhizopoda. The history of the nuclear evolution indicates a process of sexual generation, or rather a production of brood in the interior of the female parent.

Greef describes three species of Amphizonella—First, *A. violacea*, already described, $\frac{1}{250}$ inch. Second, *A. digitata*, having a distinct double outlined capsule and endosarc, with coloured granules, a vacuole, and large nucleus with distinct nucleolus; movements more active than those of the *violacea;* pseudopodia small. Third species, *Amphizonella flava*. Capsules firm, membrane loosely investing the endosarc, and following its movements; it is very extensile, so that it spreads over the pseudopodia as it spreads outwards, until quite thin and colourless, whereas it is ordinarily of a yellow tint. It has vacuoles, but no nucleus was observed.

Another Rhizopod is mentioned by Greef, which, resembling in form and colour the *Arcella vulgaris*, a water species, is named by him *Arcella arenaria*. It is found in sand under mosses, liverworts, &c. It measures $\frac{1}{250}$ inch in size; its surface is smooth, not marked as *A. vulgaris*, by a network of regular lines; its colour is deep brown, inclining to yellow. It possesses numerous pseudopodia, projecting everywhere from its surface; these are lobed, or digitate with pointed extremities. The movement of the sarcode is very active.

Much as I have shortened Dr. Greef's account of these new genera and species, I yet fear that I have exhausted the patience of my hearers. I reserve, therefore, for another occasion a notice of Cienkowski's observations on Monads. The only point to which I now, in conclusion, would direct your attention is this—that the typical Amœba, and also all Amœboid forms of the Protozoa, stand at a considerably higher point in the scale than the class Monera of Haeckel. This accurate observer and lucid writer restricts his definition of Monera to creatures which consist solely of naked protoplasm, without vacuole or nucleus, and are entirely destitute of any organization whatever, no difference of internal and external molecular constitution being perceptible; whereas our land and water Amœbæ have distinct generative organs, and their mode of reproduction closely approaches that of the Infusoria. In particular, the differentiation of the substance of the nucleus and development of ova, possibly even of sperm, as well as germ elements, reminds us of Balbiani's account of the sexual organs of Infusoria.

The morphological unit known as a cell, with or without membrane, can no longer be regarded as the primary or simplest form of living matter, and all unicellular organisms may be said to have already reached a definite standard of organization. Amœbæ, Arcellæ, &c. present a recognizable type, which apparently prevails throughout a large series of the lowest Protozoa, and from which, as a point of departure, we can trace progressive evolution. But in the group Monera we arrive at organic matter which may be either vegetable or animal, for no boundary line can be drawn where there is nothing to mark the limit. A definition founded on usual criteria of structural adaptation or characteristic function is no longer possible. Physiologically, indeed, we may perhaps assign the ingestion of foreign bodies, and particularly the digestion of animal matter, as an indication of animal function; and further, the diffused contractility of living animal plasm might be considered distinctive if we could attach to it the faculty of spontaneity. But it may fairly be doubted whether the assimilation of food or the exercise of motility is in any sense more spontaneous in a monad than in a particle of vegetable plasm. For my own part, I reject all belief in the spontaneity of action as related to *consciousness* and will in all animals destitute of cerebral ganglia. For the will of the creature I substitute that of the Creator, manifested by the conditions and laws of creation, by virtue of which animal life exists; thus I place the source of all actions of the lower animals in that organic necessity which is not of the animal's choice. Irrespective of *volitional* movement, there can be no dispute as to contraction of protoplasm under the influence of external irritants; the retraction of pseudopodia when coming suddenly in contact with foreign particles may, however, be motility without sensation or conscious perception. I compare it with what is called reflex action, in animals where this is distinctly referrible to nerve organization of a peculiar kind; but all that we know of terminal nerve-matter leads to the inference that it is a formless, soft, albuminous plasm, possessing a peculiar molecular constitution. The formed ganglion or nerve is not sensitive or motory in property merely because it is thus organized, but because its contained softer substance has an endowment associated with its ultimate constitution rather than that which we call structural differentiation into "organs."

The vital action or vital force of living organic matter, whether animal or vegetable, when reduced to its most elementary form, may be summed up in the words—self-preservation, growth, reproduction. Assimilation of matter and reproduction are equally the phenomena of vegetable and animal life, and morphologically the modes of reproduction are exactly paralleled in both cases. The process of fissure, of encystation, of development of zoospores, &c., are essentially the same in cryptogamous plants and in cryptogamous animals, and there is no *à priori* ground for expecting differences of organic instrumentation where there is no difference of function.

To return from this digression. My original intention in this paper was to place before you the widely varying life-histories of the Monad and the Amœba, and for this purpose to have given, in addition to the foregoing account of new Amœbæ forms, an abstract of Cienkowski's careful observations of certain Monadinæ. I hope to supply what is now omitted, and to discuss some questions of great interest in connection with these lowest forms of organic life—their possible origin and conditions of existence. But I must here content myself with repeating the opinion before expressed, that Amœboid phenomena are too universal to be considered distinguishing characters of any one species of animal. Our knowledge of Amœboid life is no longer confined to a particular series of individuals, nor indeed to the province of Protozoic animals alone. And our conception of matter in the Amœboid phase is that of a special molecular constitution of organic plasm, always associated with a limited specific functional activity. If, therefore, the word Amœba be retained as the distinctive appellation of the creatures originally thus named, it should not be incautiously given to animals or animal protoplasm much lower in physiological rank and structural organization. Finally, I would claim for the typical Amœba the full admission of its title to a structurally differentiated organism.—*Proceedings of the Bristol Naturalists' Society*, vol. iv. part 2.

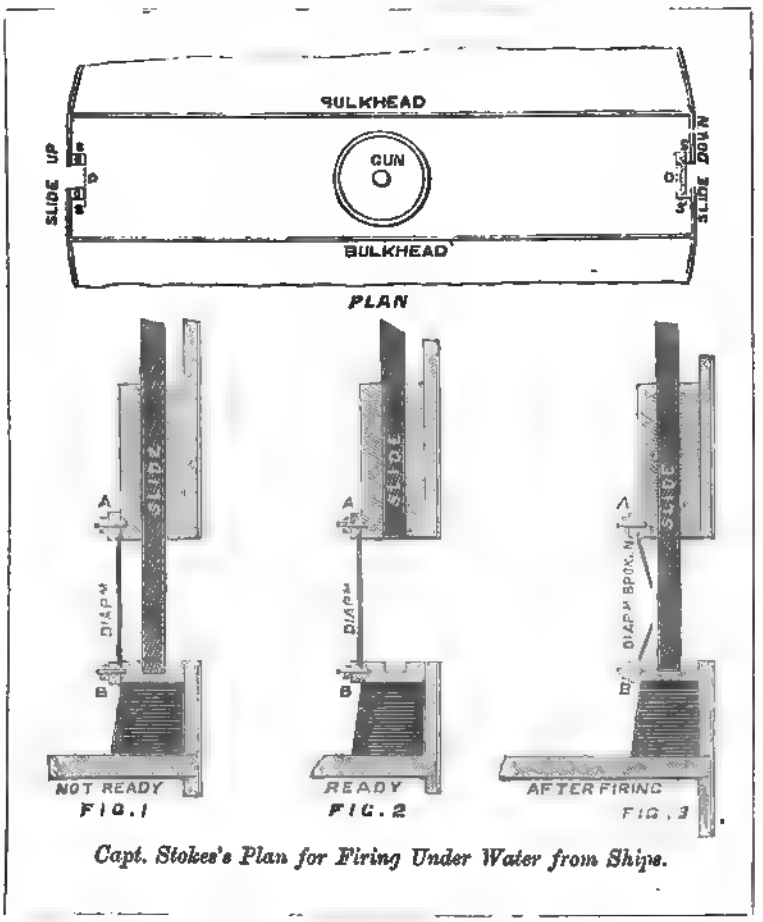
The Axial Skeleton of Tailed Batrachians.—At the meeting of the Zoological Society, on Thursday, April 28th, Mr. St. George Mivart read a paper "On the Axial Skeleton of the Tailed Batrachians." He briefly stated his views as to the composition of the skeleton in these creatures, to the effect that the axial skeleton consisted, in its most developed condition, of three parts—ascending (or epaxial) parts, lateral (or paraxial) parts, and inferior (or hypaxial) parts. That the latter were related to the inner divisions of the ventral laminæ of the embryo, and either placed above the alimentary canal or within the pleuro-peritoneal cavity, or else serially homologous with parts so placed. He also stated his conviction, that the branchial arches were not costal, or paraxial, in nature, but were rather hypaxial; that the hyoidean and mandibular arches, the palato-quadrate and trabeculæ cranii all belonged to the same category, and that, therefore, these also did not answer in nature to ribs. As to the subcaudal arches of fishes, Mr. Mivart considered that nature varied in different species; but that, as a general rule, the skeletal differentiation, was less complete in this class, and that they seemed often to correspond rather to both paraxial and hypaxial parts, and to be, therefore, parhypaxial in nature.

FIRING UNDER WATER FROM SHIPS OF WAR

SO AS TO PENETRATE THE SIDE OF A HOSTILE VESSEL BELOW THE BOTTOM STRAKE OF ARMOUR-PLATING BY MEANS OF A SHOT OR SHELL.

BY CAPTAIN OLIVER HALDANE STOKES, (LATE) ROYAL ENGINEERS, F.R.A.S, F.M.S., F.R.S., A.S.M.

THE plan represents a chamber which is formed in the vessel by means of two transverse water-tight bulkheads. This compartment communicates with the deck next above the water-line by a water-tight hatchway, forming a rectangular tube, so that even should the compartment become accidentally filled with water the safety of the vessel would not be thereby endangered. A heavy gun is placed on a circular racer with a pivot in the centre of the compartment. At each end of the latter, and in the side of the vessel *below* the bottom edge of the armour-plating, a round hole 2 ft. in diameter is formed. These holes are closed by a species of slide-valve, which works vertically so as to open or close the round holes at pleasure. The slide works in a water-tight box. A movable iron cover, A B, is attached by bolts and nuts to the inner side of the valve-box. This cover (or rather frame) has also a hole in it 2 ft. in diameter, which is closed by a thin diaphragm of copper or brass. This frame can be removed at pleasure and replaced by a solid cover of the same superficial content.



Capt. Stokes's Plan for Firing Under Water from Ships.

When the vessel is at sea, the slide and diaphragm are arranged as in fig. No. 1. When it is intended to attack, the vessel is run up as close as possible to the enemy, and the slide raised as in fig. No. 2. The gun is then fired through the diaphragm (which, is of course, destroyed), and the slide simultaneously allowed to fall as in fig. No. 3, so as to keep out the water. This can be done by electricity from the deck above. Any water that might effect an entrance could be easily removed by a centrifugal pump. In order to fire again, the cover A B must be removed and replaced by another cover or frame with a new diaphragm.

Assuming that the gun employed is 10 ft. in length, and that the beam of the vessel is 50 ft., then the muzzle of the gun will, when ready to be fired, be about 20 ft. from the diaphragm. The smoke can very easily be removed by fans and ventilators, or gun-cotton may be employed instead of gunpowder.

It will be observed that there would be no more resistance to the passage of the shot through the bore of the gun, in the plan proposed, than where a shot is fired under ordinary circumstances.

It is thought that flat-headed shot would be found preferable to any others; probably the long Whitworth steel bolt, *acting as a shell*, would prove the best projectile.

REVIEWS OF BOOKS.

The Maritime Canal of Suez, and Comparison of its Probable Results with those of a Ship Canal across Darien. By J. E. Nourse, U.S.N. Washington: Philip & Solomons. 1870.

THE enormous and apparently insuperable difficulties to be overcome in the construction of a ship canal across the American isthmus have hitherto caused the project to be looked on by all, except a few sanguine spirits, as utterly impracticable, unless, indeed, kind Nature should intervene, and by a friendly earthquake produce such a subsidence of the land as to bring the work within the scope of human appliance. The successful completion of the Suez Canal has, however, dispelled much of this feeling, and brought over many of the unbelievers to admit the practicability of what is in many respects the most important problem of the present day. It is at the same time evident that the obstacles in the latter case are immeasurably greater than those which in the former have been surmounted by the genius and perseverance of M. Lesseps. Owing to this hopeful change in public opinion, the American Government has recently ordered a new survey of the Isthmus, with the view of discovering, if possible, a route easier than any of those yet proposed, and of ultimately carrying into execution the selected plan.

As in other great engineering works, a company will probably be formed to undertake this, and will, doubtless, have little difficulty in obtaining the requisite funds, as, happily for human progress, the large class of sanguine speculators—believers in glowing prospectuses and in promises of wonderful percentages—shows no symptom of dying out. Few of us consider how much we owe to this class. But for them, the Atlantic Telegraph and the Suez Canal would still be mere speculative projects, not accomplished facts. We should, perhaps, have, even now, no speedier means of communication with distant parts of the world, Australia, or India, or America, than by slow and uncertain sailing-ships, and should be satisfied with letters many months old, instead of the news now flashed instantaneously across oceans and continents. As it is characteristic of the speculator to go on speculating, undeterred by failures, while he has money to lose,

THE GORILLA. [See p. 408.

let us hope that he will lose it only in honest projects that will be conducive to the general good. The influence which the Darien Canal would exercise on commerce and civilization is incalculable. Our readers are aware that a railway, one of the most pecuniarily successful in existence, has been for several years in operation across the isthmus. So far as passengers are concerned it fully answers its purpose; but as regards merchandise, it can be availed of only for small and very valuable articles, and is quite useless for general cargoes, which could not bear the excessively high traffic charges, and the costs of repeated transhipment, supposing for a moment the possibility of the railway being able to provide adequate means of conveying the goods. The Honduras railway across the isthmus, now in course of construction, will probably enable a somewhat heavier and cheaper class of goods to be transmitted, but the great bulk of the merchandise usually carried by sea must continue to be conveyed by the present tedious route until the Atlantic and Pacific Oceans again hold communication with each other through the isthmus, as they once did, at a remote period, long before man had appeared on the scene. This canal, if ever completed, will certainly produce in the carrying trade of the world, changes too profound and extensive to be easily foreseen; and in these changes no nation has a deeper interest than England. No better illustration of

the force of our remarks on this important subject can be had than that which is afforded in the lucidly-written and amply-illustrated work whose title is above given.

The Book of Nature and the Book of Man. By CHARLES O. GROOM NAPIER, F.G.S. London: John Camden Hotten. 1870.

IN this very remarkable work—indeed, one of the most wonderful essays on the subject which have ever been published—"man is accepted as the type of creation—the microcosm—the great pivot on which all the lower forms of life turn." It is truly a work which the ordinary reviewer is incompetent to deal with adequately, for besides its many originalities of diction, it is the expression of some of the most complex and least understood operations of the human mind. Mr. Napier is not a man who, like most of our mere fact-collectors in science, is content with simple narrative. He is nothing if not subjective, and when the commonplaces of Natural Science have passed through the crucible of his mind, they acquire a brilliancy quite *sui generis*, and become unappreciable by the common herd of readers, who are incapable of vast and untrammelled metaphysical conceptions. It is perhaps fortunate for ourselves under these circumstances that the volume before us is prefaced by Lord Brougham, who tells us that "the author has strode the gulf between physics and metaphysics, mind and matter, instinct and reason, God and man." And can we add anything to so limitless a programme. Indeed, we are at times reminded by Mr. Napier of that patriotic American who held that the "States" were "bounded on the east by the rising sun and on the west by the day of judgment." But after all this is only metaphor, and Mr. Napier has seriously done all that our great Lord Chancellor, without the faintest irony, has affirmed! We cannot deal critically with this singular work; but we may hope to induct our readers into a few of its mysteries by quoting some of the passages which strike us as among those more immediately deserving attention. Here, for example, is the author's broad and philosophic mode of regarding the animal kingdom as a whole:—

"When we compare the ages of man's history with the different classes of animals, we see that the same analogy in great detail pervades them both. Thus in the lowest Infusoria we see a type of the world in the days of Adam after his fall; while the Polyp class is an illustration of the generation from Adam to Noah, gradually progressing. A great step was made by the builders of Babel, who, like the Echinodermata, first began to be covered with a shell or house. The period of the Entozoa was a progressive stage, but smaller and insignificant, and well illustrates the divided minute nationalities into which men were separated; while the Rotatoria, a connecting link with far higher classes, typify the approach to civilized life on which nations entered as they commenced a period of profitable activity. Nations had now begun to whirl on the wheels of separate existence towards that great goal, the development of man. The Ringed-worms are typical of the degraded life of these early nations; but some rose high in their class, so as to become representatives of the more elevated of mankind in a dark age. The Insect order, in which most of the creatures are very small, yet very ingenious, reminds us of the age of small tribes, but great inventions; while the Crustacea, inhabiting the water, suggest the life of the earliest mariners. The Mollusca are comparatively helpless, and have few influential members capable of accomplishing great deeds. They typify weak, flabby nations."

On the subject of the cultivation of bulbs the author is equally original:—

"The Dutch have been famous cultivators of bulbous roots, mainly to make money, but perhaps partly from a love of *multum in parvo*, or concentrated force in a little space. The growth of a bulb is like that of the Dutch, always expansive. In youth, in height; in after life, in girth; both individually and nationally. They find in those flowers whose growth is so regular, so certain, and so little dependent on changes of temperature, a solace which contrasts favourably with what otherwise might be gloomy in landscape gardening. The bulb, by its mode of growth, illustrates Teutonic progressive civilization. The Dutch division of the Teutons put their feet forward slowly, but scarcely ever back, retaining tenaciously what they have once seized."

But it is on arriving at the Protozoa that Mr. Napier's genius culminates in establishing the following really astounding analogies:—

"Sponges (*Halcyonina*, Hœven) are highly important in commerce. Their very softness and flexibility give them a preference over their more stony kindred the corals; yet the stony ones, though brittle, are alone suitable as foundations. The sponge is a type of what is soft, absorbent, and impressible; of the kind of mind and brain that can apparently take in a great deal, but cannot retain; soon becoming dry, and liable, by pressure, to be turned into any shape or form. These men have their use. They are commonly inclined to spread over a considerable surface, yet have little solidity unless, like the frozen sponge, they are under powerful influences; they then attain a gravity not their own. But only lay hold of them with a warm hand, and they soften helplessly in your grasp, absorbing your intemperate heat at the same time. The sponge absorbs much liquid; hence it is used to take up what cannot be got at in any other way. Thus the expression 'sponging-house' is used to imply the house of temporary detention, in which bailiffs deposit debtors, who, by yielding to the demand made upon them may escape from the present pressure."

In conclusion, we may observe that the cuts and photographs intercalated with the text are many of them excellent, and we beg to refer our readers to the figure of the gorilla on page 407 as a sample of the illustrations in Mr. Groom Napier's volume.

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Proposed Ship Canal from Manchester to Liverpool.—In consequence of the success of the Suez Canal, the proposal of a ship canal from Manchester to Liverpool has been revived. It is proposed to do with the River Irwell what Glasgow has done with the Clyde. Mr. Hamilton Fulton, C.E., has made a survey, and proposes, after cutting off the bends, to widen and deepen the bed of the river. It would be a tidal channel of 33 miles, of which 19 would be excavations and deepening, and 14 training; 200 ft. wide at the surface and 80 ft. at the bottom, with a *minimum* depth of 22 ft. The cost of land, construction of wharfs, roads, and railway bridges, and compensation for mills, &c., is estimated at £1,000,000, and the cost of deepening, widening, and dredging, will not exceed £1,500,000.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

The Controversy respecting the Action of Metallic Sodium on Acetic Ether.—*From* Professor J. A. Wanklyn.

Sir,—The list of chemists who find that the alkali-metals do NOT disengage hydrogen when they act upon acetic ether now includes Löwig and Weidmann, whose experiments were published in the year 1840; myself, who published results in 1868, and reiterated them in 1870; and Ladenburg, whose work on the subject has just appeared in the journal of the Chemical Society of Berlin, date 1870.

The chemists who have found the contrary are—Genther, and his pupil Greiner, whose conjoint work bears the date 1864; and Frankland and Duppa, whose conjoint work was published in the *Philosophical Transactions* in 1866, and who have again, in February, 1870, reiterated their statement before a meeting of the Royal Society, and published it in the *Proceedings* of that learned body.

Questions in science are not decided either by counting hands or by weight of authority, but by quite different methods; and though the number of chemists who have affirmed the evolution of hydrogen equals those who have denied it, and despite of the great weight of the authority that has most persistently asserted the evolution of hydrogen, the question is now decided—henceforth our text-books of chemistry will teach that there is no evolution of hydrogen when alkali-metals act on acetic ether.

Happily, the long controversy just concluded is without many parallels in the history of chemistry, or indeed of science generally. Conflicts of chemical theory there have been—the antiphlogistic theory fought the theory of phlogiston; the theory of compound radials fought the theory of substitution; there was the controversy respecting the atomic weight of oxygen, whether it be eight or sixteen; and many other questions of theory have for a time divided the chemical world. Errors of observation or of experiment have likewise been made, and corrected by those that made them or by later observers. But it is, happily, a thing quite unprecedented in the history of our science, for a chemist who has made an error to persist in it after it has been corrected and the sources of error explained. In order that chemists may form an adequate notion of the extraordinary character of Dr. Frankland's recent reply to me, I will quote from my paper (date March, 1869, *Phil. Mag.*, vol. xxxvii. p. 179):—

"Owing to the occurrence of this reaction at 100° C." (*i. e.*, the reaction by which alcohol and acetate of ethylene-sodium are produced from ethylate of sodium and acetic ether), "the attempts made by various chemists to render acetic ether free from any alcohol with which it might be contaminated by distilling it off sodium, have had the reverse result; and, continually producing alcohol, have rendered the ether more impure. By the action of sodium on acetic ether there is produced sodium-triacetyle and hydrated oxide of ethylene-sodium, which latter attacks excess of acetic ether slowly at water-bath temperatures. A sample of acetic ether, which, from the mode of its preparation, must have been originally almost, if not quite, free from alcohol, became, after several distillations off a small quantity of metallic sodium, charged with alcohol to the extent of 15 per cent. This circumstance, which really no one can be blamed for not expecting and providing against, has probably led Genther, Frankland, and Duppa astray."

What, however, shall we think when afterwards Dr. Frankland goes before the Royal Society and describes the results given by acetic ether which had been digested with and distilled off sodium-amalgam as results given by alcohol-free acetic ether?

The controversy has been remarkable in many ways. It is notorious (and I think I need not particularly allude to events which are, I believe, not unknown to many chemists, at any rate in this country) that other weapons besides those that are legitimate weapons in controversy have been employed against me. For example, in 1868, during the course of the water-controversy and the earlier stages of the ether-controversy, I received a message from a Fellow of the Royal Society, high in office and in influence, that "if I had treated Frankland better, I should have been elected a Fellow of the Society as a matter of course."

This message is an epitome of the actual relation of our Royal Society to those who are independently and fearlessly seeking the truth.

Chemistry will be extinct among us when chemists cease to be ready to undergo persecution for the advancement of the science; but chemistry cannot flourish, and does not flourish, in England, where, as at the present time, the maintaining of chemical truth is the abandonment of a chemist's career. I am, Sir, yours, &c.,

London, April. J. A. Wanklyn.

On Velocipedestrianism.

Sir,—It would be Hampdenism to deny that different people require different quantities of bodily exercise, specially when such a truism is stated by a medical man; nor would it become me to criticise Mr. Barkas's very elaborate exposition of the muscles called into play by bicyclism—it is a shorter word than velocipedestrianism. I do not, however, think it probable that the bicycling public will trouble medical advisers to any great extent before entering upon a favourite amusement, whether that be bicycling, skating, hunting, sliding, or rackets. We are unwise; a medical adviser should be at the door of each English home, and be ready to convert out-goers into in-goers, or *vice versâ*, according to the state of their "respiratory and circulatory systems."

But will you allow me to hesitate before putting much confidence in Mr. Barkas's knowledge of the action and use of mechanical apparatus? This, as well as his experience, must be small, since he confidently assumes that bicycles "are not of the slightest advantage for making long journeys." Will he kindly define what he means by *long* journeys? All practised bicyclists, *not amateurs*, hold a very different opinion; and does not Mr. Barkas contradict himself strangely when he says that "the feeling of want of power gradually disappears as the rider becomes more and more proficient in the exercise"? Any one who has studied the mere elements of mechanics, and has thought over the processes of walking and bicycling, will easily understand how a man can pass over a given distance in much less time and with much less fatigue, by means of the bicycle, than if he were walking; unless, indeed, the ground chosen is unfairly uphill. I will not encroach upon your valuable space by entering minutely into such simple matters, which are not purely scientific. Permit me, in one sentence, to apologize for proceeding thus far, and to impress upon your readers that bicycling is good for the health, as rowing is, and is likewise good for long journeys, except over hilly country. They need not trouble about medical advisers, if they remember that toleration in all things should be practised, and that over-fatigue, however occasioned, is disagreeable. Who will say that bicycling is a more violent exercise than running to catch an obstinately-punctual last midnight train? In such a very possible case as this, Mr. Barkas would have the unfortunate traveller stop to be "assured that his respiratory and circulatory systems were in good order by his medical advisers." Would Mr. Barkas? I am, &c.,

April 30. Bicyclist.

The Weather of March, 1870.—*From the* Rev. F. B. Falkner.

Sir,—I beg to send you a few particulars of the weather of last month, as deduced from observations conducted by myself in this neighbourhood. The circumstances of atmospheric temperature and moisture refer to a stratum of air 4 ft. from the ground. The barometer is 335 ft. above sea-level. The solar thermometer has its bulb blackened and inclosed in a vacuum glass chamber, and is 3½ ft. from the ground. Another thermometer is freely exposed to the sky, and indicates the lowest temperature to which unsheltered vegetation near the earth's surface is subjected in the course of the night.

General Results.

Mean maximum temperature of air	46·2°
Mean minimum temperature of air	32·6°
Mean diurnal range of temperature of air	13·6°
Highest temperature of air, on the 31st	56·0°
Lowest temperature of air, on the 14th	20.4°
Total range of temperature of air	35·6°
Mean temperature of the air	39·3°
Mean temperature of the dew-point	35·2°
Highest 9 a.m. reading of the dew-point, on the 17th	50·0°
Lowest 9 a.m. reading of the dew-point, on the 12th	23·0°
Highest reading of "solar" thermometer, on the 31st	97·1°
Lowest temperature of unsheltered vegetation, on the 14th	10·0°
Mean weight of water in a cubic foot of air	2·3grs.
Rainfall	1·440 in.
Mean height of the barometer	29·730 in.
Total range of the barometer	0·940 in.
Mean humidity of the air	·86

In the lower regions of the atmosphere, northerly winds blew more frequently than southerly, in the ratio of 7 to 2; and easterly winds prevailed over westerly in the ratio of 5 to 4. There were 16 frosty nights, and two days were frosty at 9 a.m. The temperature of the air fell below 25 degrees on 5 nights. On the other hand, it rose above 50 degrees on 8 days, and above 55 degrees on 2 days. The 9 a.m. reading of the barometer was above 30 in. on 9 days, and below 29½ in. on 8 days. The rainfall for the three months, January, February, and March, 1870, amounted only to 4·31in.

I remain, Sir, your obedient servant,

F. B. Falkner.

Appleby Grammar School, Leicestershire, April 26.

Underground Temperature.

Sir,—I inclose my usual report of my 2 ft. below surface thermometer.

If you refer to my last month's (March) report you will see on the 18th the mercury rose two degrees, on that day there was an earthquake in St. John's, New Brunswick; a fall of rock in a Cornish mine (a very unusual thing); and a loss of a ship on the coast of France, when the captain thought he was on the English coast, and upon trial, by the Board of Trade, he was *acquitted*. Doubtless those who sat in judgment on him thought he was not to blame.

Did an earthquake cause a variation in his compasses?

1869.		1870.	
April 5	42°	April 1 and 2	39°
8	42°	3 to 5	40°
10	44°	6 to 10	41°
11	45°	11	42°
12	46°	12 to 14	43°
13	47°	15 and 16	44°
17	46°	17	45°
19	47°	18 to 21	46°
26	49°	22 and 23	47°
30	51°	24 to 28	48°
		29 and 30	47°

Havant, May 2. C. J. R.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

Thursday, April 28th.—The following papers were read:—"On the Organs of Vision in the Common Mole," by Robert James Lee; communicated by Samuel Solly, F.R.S.—The eye of the common mole and the structures connected with it undergo some remarkable changes during the growth of the animal. The gentleman who does me the honour to present the results of an investigation into that subject to the Royal Society was desirous that it should be undertaken in order to ascertain the cause of the anomalous condition in which the organ of vision is found in the adult mole.

It was the suggestion of Mr. Solly that an examination of the eye of the young or fœtal mole might assist in the explanation; for Mr. Solly had reflected much on the subject, and entertained reasons for believing that such an inquiry would be attended with a satisfactory result.

It is known that there is distinct evidence of the existence of an eye and other parts concerned in the endowment of sight in many of the various species of the mole genus. To what extent, however, the defective state of the organs permit of sight, or whether the animal is totally blind, are questions still undecided.

That the organ of vision in the young mole would be found in a more perfect state than in mature age was what Mr. Solly anticipated, while he conjectured, for physiological reasons, that the cause of the difference between them would be found to be a process of atrophy or degeneration in the various structures essential for the enjoyment of sight.

The specimens sent me for the purpose of examination consisted of a female mole, which appeared from its dimensions to have attained the full period of development, if it had not somewhat exceeded it, and of six unborn young about 1¼ in. long, and, as far as I could judge, beyond the middle of the period of gestation.

Before entering into anatomical details, I venture to review briefly the researches which have been made by anatomists into the subject. A summary of the views entertained by those who preceded him is given by Gottfried Treviranus, in his work published in 1820, "*Vermischte Schriften anatomischen und physiologischen Inhalts*, in the chapter on the Nerves of Sense in Mammalian Animals. From this account it appears that it was Zinn who first described an optic nerve in the mole, and declared it to be a branch of that division of the fifth pair of nerves which is distributed to the nose.

The description by Zinn was published in the fourth volume of the Commentaries of the Royal Society of Gottenburg. "The optic nerve" he says, "is long and of considerable tenuity. Its origin is the same as that of the very large nerve which passes to the proboscis. It takes a long oblique course, lying above the muscles of the nose, and passing in an outward and backward direction, surrounded by dense structures, is finally inserted into the posterior part of the globe of the eye in the line of the axis of vision."

In 1813 Von Tiedemann published a description of the optic nerve and the fifth pair, which differed in a very important respect from the account given by Zinn; for he says that although the optic nerves are small and difficult to distinguish, yet they exist as separate nerves, and present the same general character as in most of the mammalia. Tiedemann carried his investigations still further, and declared the absence of the third, fourth, and sixth pairs of nerves. He described certain filaments, which he stated to be unconnected with the optic nerve, and to be similar to those branches which are found in the tissues around the eye in other animals. The absence of the third, fourth, and sixth pairs of nerves was subsequently asserted also by Carus; but his account of the origin and termination of the optic nerves is not quite intelligible to me. It appears, however, that the conclusions of Treviranus and Carus agreed that there was some connection between the optic nerve and the fifth, which sufficed to supply the mole to a certain degree with the sense of sight. Indeed, the chief physiological fact which Treviranus endeavoured to establish in the chapter of the work alluded to, was that the nerves of one particular and special sense were capable, under certain circumstances, of becoming endowed with the properties of nerves of another and different sense. "The fifth pair of nerves in some mammalia supply the place of the most important nerve of sense" is the introductory sentence in the chapter; or, in other words, that a nerve of touch and feeling may become a nerve of sight, that is, sensitive to the rays of light; and he concludes the chapter thus:—"I cannot but agree with Carus that the optic nerve and the fifth branch enter into connection in the eye to produce the retina." This opinion met with opposition from Prof. Müller, who controverted it by the statement that true optic nerves had been exhibited to him by Dr. Henle (Baly's translation, p. 842).

From a remark of M. P. G. Pelletan, in his *Mémoires sur la Spécialité des Nerves des Senses*, quoted by Mr. Solly in his work on the Brain, it would appear that that anatomist had made a very careful examination of the organs of vision, both in the adult and fœtal mole, for he "recommends the dissection of either fœtal moles or very young ones in whom the optic foramen is still distinct." The importance of this remark consists in the proof that Pelletan had observed that the optic foramina undergo somechange subsequent to the birth of the animal.

Von Siebold has published the results of investigations into the difference between the eyes of certain species of Talpa. "The eyes are rudimentary," he says, "in the mole and *Spalax typhlus*, which live underground; and above all in *Talpa cæca* and the Chrysochlores are the eyes rudimentary. They are a little more developed in the Musaraignes and the common mole. According to Ollivier (*Bulletin de la Société Philomathique*, vol. ii. No. 38, p. 105), all the ordinary elements of the eye are found in *Spalax typhlus*."

Leydig, in his *Handbuch der Histologie*, has someimportant remarks on the eyes of blind animals, and has described, in Muller's *Archives*, 1854, p. 346, the cellular structure of the lens of the mole's eye, as presenting the character of embryonic structure, from which he concludes that the lens remains in its primitive embryonic condition.

Mr. Solly's investigations were directed to the state of the optic commissures at the base of the brain. "In the mole," he says, "in which the optic nerves are so extremely minute that they have often escaped detection, and by many authors described as entirely wanting, these commissural fibres are found distinctly crossing the base of the skull opposite the usual situation of the optic commissure; while the small black speck, evidently the rudiment of the eye, is supplied by a minute branch from the fifth pair" (p. 289, *op. cit.*).

In Professor Owen's work on the *Comparative Anatomy and Physiology of Vertebrates* (vol. iv. p. 246), the organ of sight, like that of smell, is stated to be "wanting in a few mammals, the eyeball being reduced to the size and condition of the ocellus in Amblyopsis, and to its simple primitive office of taking cognizance of light, a filament of the fifth aiding a remnant of the proper optic nerve. The moles, especially the Italian kind, *Talpa cæca*, and mole-rats exemplify this condition, in which, as in *Spalax typhlus*, the skin passes over the ocellus without any palpebral opening or loss of hair."

Mr. Herbert Mayo has given a similar description in his *Physiology*, and has supplemented it by a drawing, in which the fifth nerve is represented as sending a filament directly to the globe of the eye.

From the above enumeration of the views entertained by anatomists regarding the eye and optic nerve of the mole, it is apparent that attention has been directed by some to the eye in particular, and to the structures intimately connected with it, while others have arrived at their conclusions from examination of the interior of the skull and the optic region of the brain.

It remained, therefore, to ascertain the condition of the optic nerve in the posterior part of the orbit, especially that portion of the nerve which lies in the optic foramen, and thus endeavour to connect the appearances described in the eye with those observed at the base of the brain.

It is proposed to give an account of the dissection of the full-grown mole, in order to contrast the state of the eye, the optic nerve, and the cranium, with that which those parts present in the fœtal mole.

following such an arrangement of the facts that the important points of difference shall be apparent without separate comparison.

The eye of the common mole presents the appearance of a minute black and shining bead, closely attached to the skin of the head, and concealed by the hair so completely that it is difficult sometimes to discover it. In removing the skin the small globe is easily detached at the same time, and no indication remains of the exact position in which it was situated. This shows that in the mole the cavity of the orbit is wanting, and that the structures usually found in the vicinity of the eye are in a different condition from that which they present in other mammalia. It is necessary, therefore, to divide the skin around the base of the eye in order to preserve the connection between the globe and the subjacent tissues.

Beneath the eye, and forming a basis on which it rests, is a firm mass of cellular fibrous tissue which assumes on dissection a fusiform shape, with an attenuated portion passing towards the base of the skull. The filament becomes so exceedingly delicate in the deeper part of the orbit, that the difficulty of ascertaining its precise condition is probably the reason of the difference of opinion on the subject.

In Mr. Solly's specimen there was found to be no attachment whatever of the filament to the base of the skull; but in a former dissection of a smaller, and probably younger specimen, the continuity between the bone and the tissue was evident.

The filament of tissue above described, and the connection which it formed between the eye and the skull, induced me to examine it microscopically, in order to ascertain whether it contained nervous fibres, or possessed any of the characters of the optic nerve.

It exhibited a tendency to divide in a longitudinal direction when needles were applied to it, and presented the appearance of cellular tissue, without, however, any trace of nerve-fibre. It will be seen, nevertheless, from the description of the optic nerve in the fœtal mole, that this delicate thread is the only vestige which remains of that important part of the organs of vision in the full-grown mole.

With regard to some minute branches of nerves and blood-vessels which pass into the tissue forming the base of the eye, both on its outer and inner side, it is not in my power to say definitely from whence they come, as their minute size prevented me from tracing them in the deeper part of the orbit to their points of exit from the skull.

The eye of the full-grown mole presents a surface uniformly black and glistening, in which there is no indication of a cornea and sclerotic distinct from one another, nor any evidence of an iris or pupillary aperture. Within the globe, when ruptured with the points of needles, a layer of black pigmentary particles was found to line the internal surface of the dense structure which corresponds to the sclerotic.

In addition, there was a confused mixture of grey and white granular substance, in which there was no distinct evidence of remains of the usual contents of the globe of the eye, though, as will be seen, those structures exist in fœtal life.

The specimens were sent to me preserved in alcohol, consequently the brain was firm, and easy to be removed entire from the cranium.

On raising the anterior lobes gently from the base of the skull, it was ascertained that no nerves connected the brain with the bone anterior to the fifth pair. The base of the brain also exhibited an entire absence of the optic nerves beyond a vestige in a very minute chiasma, as described by Mr. Solly.

On examining the internal surface of the base of the skull, the usual foramina for the optic nerves are found to be wanting, a condition which is observed with facility in the dried specimens in the Museum of the Royal College of Surgeons. Among these there is one in which there is a vestige of an optic foramen on the left side of the head, while on the opposite side the surface is smooth and perfect.

In the arrangement of the details which have been given above of the appearances observed in the course of the examination, attention has been directed to three points in particular—namely, to the condition of that part of the optic nerve which is situated externally to the skull, and which exists as a mere thread of connective tissue; secondly, to the eye itself, and the structures within, so far as it was necessary to consider them in their efficiency for optical purposes; thirdly, to the internal surface of the skull in its relation to the part of the brain from which the optic nerves take their origin.

The following description of the various structures in the fœtal mole will be more general than the above account of them in the full-grown mole, as five specimens instead of one were examined.

On the removal of the skin and a layer of muscular tissue subjacent, a part of the globe of the eye is exposed. When the whole side of the face and the temporal region are dissected, the eye is found to be in close proximity to the large branch of the facial nerve.

The eye has the usual appearance presented by the organ in most fœtal mammalia. In form globular, and in size proportionate to the head of the animal; the cornea translucent; the sclerotic perfectly distinct, and of dense white tissue; the iris apparent through the cornea, with a clear pupillary aperture.

Between the eye and the facial nerve a small portion of the optic nerve is seen in the superficial dissection, and appears to form an upright peduncle for the globe.

It is necessary to divide the seventh pair in order to examine the deeper parts of the orbit. When the dissection is completed, and the optic nerve exposed in its whole extent, from the eye to the base of the cranium, the branches of the fifth pair of nerves are brought into view. The main branch of the second division of the fifth nerve lies a little below the optic nerve, parallel with it, and supplies large and numerous branches to the anterior part of the face. There is no necessity to describe minutely the appearance presented in the deep dissection of the orbit, as I observed nothing unusual to require particular notice. There are some minute muscles attached to the globe which do not admit of separation into distinct parts, but completely surround the posterior half of the globe.

To trace the optic nerve through its foramen to the brain was successfully accomplished in only one dissection. After exposing the optic nerve and the eye completely, all the surrounding parts were removed, and a section made through the skull so as to exhibit a lateral view of the interior of the cranium.

The brain itself was disorganized in all the young specimens; but in the dissection just alluded to the optic nerve was seen to pass through the base of the skull, and to enter the membranes to a short distance, so that it would have been possible, if the brain had remained perfect, to trace it to its origin.

With regard to the eye itself, no difficulty was experienced in separating the iris, choroid, and lens. The other structures usually existing in the eye had been so long subjected to the influence of the alcohol that I could not determine their condition.

It must necessarily happen that many interesting observations are made in the course of an investigation like that which has been briefly described, and many minute details might have been added to this account; but it appeared to me to be desirable to limit the details, as far as possible, to those which were sufficient to establish the remarkable physiological fact that the mole, at the time of birth, is endowed with organs of vision of considerable perfection, while in mature age it is deprived of the means of sight in consequence of certain changes which take place in the base of the skull, terminating in the destruction of the most important structures on which the enjoyment of the sense of sight depends.

"On an Aplanatic Searcher, and its Effects in improving High-Power Definition in the Microscope," by G. W. Royston-Pigott, M.A., M.D. Cantab., M.R.C.P., F.R.A.S., F.C.P.S., formerly Fellow of St. Peter's College, Cambridge; communicated by Professor Stokes, Sec. R. S.—The Aplanatic Searcher described by Dr. Pigott is intended to improve the penetration, amplify magnifying power, intensify definition, and raise the objective somewhat further from its dangerous proximity to the delicate covering-glass indispensable to the observation of objects under very high powers.

The inquiry into the practicability of improving the performance of microscopic object-glasses of the very finest known quality was suggested by an accidental resolution in 1862 of the Podura markings into black beads. This led to a search for the cause of defective definition, if any existed. A variety of first-class objectives, from the $\frac{1}{8}$ to the $\frac{1}{4}$, failed to show the beading, although most carefully constructed by Messrs. Powell & Lealand.

Experiments having been instituted on the nature of the errors, it was found that the instrument required a better distribution of power; instead of depending upon the deepest eyepieces and most powerful objectives hitherto constructed, that better effects could be produced by regulating a more gradual bending or contraction of the excentrical rays emanating from a brilliant microscopic origin of light.

It then appeared that delusive images, which the writer has ventured to name *eidola*,[1] exist in close proximity to the best focal point (where the least circle of confusion finds its locus).

(I.) That these images, possessing extraordinary characters, exist principally above or below the best focal point, according as the objective spherical aberration is positive or negative.

(II.) That test-images may be formed of a high order of delicacy and accurate portraiture in *miniature*, by employing an objective of twice the focal depth, or, rather, half the focal length of the observing objective.

(III.) That such test-images (which may be obtained conveniently two thousand times less than a known original) are formed (under precautions) with a remarkable freedom from aberration, which appears to be reduced in the miniature to a minimum.

(IV.) The beauty or indistinctness with which they are displayed (especially on the immersion system) is a marvellous test of the correction of the observing objective, but an indifferent one of the image-forming objective used to produce the testing miniature.

These results enable the observer to compare the known with the unknown. By observing a variety of brilliant images of known objects, as gauze, lace, an ivory thermometer, and sparkles of mercury, all

[1] From εἴδωλον, a false spectral image.

formed in the focus of the objective to be tested with the microscope properly adjusted, so that the axes of the two objectives may be coincident, and their corrections suitably manipulated, it is practicable to compare known delusions with suspected phenomena.

It was then observed (by means of such appliances) that the aberration developed by high-power eyepieces and a lengthened tube, followed a peculiar law.

A. A lengthened tube increased aberration faster than it gained power (roughly the aberration varied as v^2, while the power varied as v).

B. As the image was formed by the objective at points nearer to it than the *standard distance of 9 in.*, for which the best English glasses are corrected, the writer found the aberration diminished faster than the power was lost, by shortening the body of the instrument.

C. The aberration became negatively affected, and required a positive compensation.

D. Frequent consideration of the equations for aplanatism suggested the idea of searching the axis of the instrument for aplanatic foci, and that many such foci would probably be found to exist in proportion to the number of terms in the equations (involving curvatures and positions).

E. The law was then ascertained that power could be raised, and definition intensified, by positively correcting the searching lenses in proportion as they approached the objective, at the same time applying a similar correction to the observing objective.

The chief results hitherto obtained may be thus summarized.

The writer measured the distance gained by the aplanatic searcher, whilst observing with a $\frac{1}{4}$-in. objective with a power of seven hundred diameters, and found it *two-tenths of an inch increase*; so that optical penetration was attainable with this high power through plate-glass nearly $\frac{1}{4}$ in. thick, whilst *visual* focal depth was proportionably increased.

The aplanatic searcher increases the power of the microscope from two and a half to five times the usual power obtained with a third or C eyepiece of 1 in. focal length. The $\frac{1}{8}$ thus acquires the power of a $\frac{1}{16}$, the penetration of a $\frac{1}{4}$. And at the same time the lowest possible eyepiece (3-in. focus) is substituted for the deep eyepiece formed of minute lenses, and guarded with a minutely perforated cap. The writer lately exhibited to Messrs. Powell & Lealand a brilliant definition, under a power of 4,000 diameters, with their new "$\frac{1}{8}$ immersion" lens, by means of the searcher and low eyepiece.

The traverse of the aplanatic searcher introduces remarkable chromatic corrections displayed in the unexpected colouring developed in microscopic test objects.[2]

The singular properties, or rather phenomena, shown by eidola, enable the practised observer in many cases to distinguish between true and delusive appearances, especially when aided by the aberrameter applied to the objective to display excentrical aberration by cutting off excentrical rays.

Eidola are symmetrically placed on each side of the best focal point, as ascertained by the aberrameter when the compensations have attained a delicate balance of opposite corrections.

If the beading, for instance, of a test-object exists in two contiguous parallel planes, the eidola of one set is commingled with the true image of the other. But the upper or lower set may be separately displayed, either by depressing the false eidola of the lower stratum, or elevating the eidola of the upper. For when the eidola of two contiguous strata are intermingled, correct definition is impossible so long as the aperture of the objective remains considerable.

One other result accrues: when an objective, otherwise excellent, cannot be further corrected, the compound glasses being already closely screwed up together, a further correction can be applied by means of the adjustments of the aplanatic searcher itself, all of which are essentially conjugate with the actions of the objective and the variable positions of its component lenses; so that if δx be the traversing movements of the objective lenses, δv that of the searcher, F the focal distance of the image from the objective when δx vanishes, f the focal distance of the virtual image formed by the facet lenses of the objective.

$$\frac{\delta v}{\delta x} = -\left(\frac{F}{f_1}\right)^2.$$

The *appendix* refers to plates illustrating the mechanical arrangements for the discrimination of eidola and true images, and for traversing the lenses of the aplanatic searcher.

The plates which the author supplied with the paper also showed the course of the optical pencils, spurious disks of residuary aberration and imperfect definition, as well as some examples of "high-power resolution" of the Podura and Lepisma beading, as well as the amount of amplification obtained by camera-lucida outline drawings of a given scale.

"On Supra-annual Cycles of Temperature in the Earth's Surface-crust" was a paper, by Professor C. Piazzi Smith, F.R.S., which, owing to press of matter, must stand over till our next number.

[2] Alluded to by Mr. Reade, F.R.S., in *Popular Science Review* for April, 1870.

ETHNOLOGICAL SOCIETY.

APRIL 26TH.—Professor Huxley, F.R.S., president, in the chair. Dr. Donovan read a short paper on the importance to the ethnologist of a careful study of the characters of the brain.

Mr. E. B. Tylor then read a paper "On the Philosophy of Religion among the Lower Races of Mankind."—Taking the doctrine of spiritual beings as the minimum definition of religion, the author described it as *Animism*. The conception of a soul, combining the ideas of ghost and vital principle, forms the starting-point of religious philosophy among the lower races. Animals and inanimate beings are also supposed to possess souls, and all nature is acted on by soul-like spiritual beings, many of which may be human souls or manes. Trees, rivers, &c., are also supposed to possess spirits, and the savage polytheist thence extends his conceptions to that of greater deities, as the sun and moon. Dualism springs up in religion by separating the causes of good from those of evil. The culminating conception of a Supreme Deity is well known to many of the lower races.

Mr. Pusey, Mr. Howorth, and Dr. Hyde Clarke spoke upon this communication.

CHEMICAL SOCIETY.[1]

APRIL 21ST.—Professor Williamson, F.R.S., president, in the chair. Mr. T. Patchett was elected a fellow.

Professor Roscoe, F.R.S., delivered a lecture "On Vanadium."—This metal was discovered in 1830, by Sefström, in the celebrated Swedish bar-iron made from the Taberg ore. Sefström ascertained some of the most peculiar characters of this substance, proved it to be a new element, and prepared some of its compounds in the pure state. The reactions by which vanadium can be separated and distinguished from all the other elements are:—1st. The formation of a soluble sodium vanadate when the vanadium compounds are fused with sodium carbonate. 2nd. The formation of an insoluble ammonium vanadate when sal ammoniac is added to the solution of a soluble vanadate. 3rd. The production of a splendid blue solution when this ammonium salt, dissolved in hydrochloric acid, is warmed with reducing agents, such as oxalic acid.

Sefström, not having leisure to prosecute the full examination of the properties of the new metal, handed over his preparations to Berzelius; and it is to the investigations of the great Swede that we owe almost all our acquaintance with the chemistry of vanadium.

Since Berzelius's time, vanadium has been discovered in many minerals, of which a lead ore containing lead vanadate, and called by the mineralogists, vanadinite, is the most important.

In 1865 Professor Roscoe came into possession of a plentiful source of vanadium, in a by-product obtained in the preparation of cobalt from the copper-bearing beds of the lower Keuper Sandstone of the Trias, at Alderley Edge, in Cheshire. Following, in the main, the process of preparation adopted by Sefström, Professor Roscoe obtained, from the above-mentioned source, several pounds of pure ammonium vanadate, from which all the other compounds of vanadium can be prepared.

What, now, were the conclusions to which Berzelius arrived, from his experiments concerning the constitution of the vanadium compounds? He assigned to its three oxides the formulæ VO, VO_2, and VO_3, whilst the chloride was represented by VCl_3. The atomic weight of the metal he found to be V=68·5.

Some years afterwards, Rammelsberg observed that vanadinite, a double salt of lead-vanadate and lead chloride, is isomorphous with apatite and with mimitesite, the former containing phosphoric, the latter arsenic acid. This crystallographic analogy would lead us to conclude that the oxide of vanadium in the vanadinite has the formula V_2O_5, agreeing with the corresponding oxides of phosphorus and arsenic, P_2O_5 and As_2O_5; but the unyielding chemical facts of Berzelius compel us to view the oxide in question as VO_3. It was, then, evident that here was either an exception to the law of isomorphism, or else Berzelius's views were erroneous.

Professor Roscoe, in order to endeavour to clear up this question, had carefully repeated Berzelius's experiments, and he found them confirmed in every particular; but, having pursued the subject further than Berzelius, he had succeeded in obtaining the key to the enigma presented by the above anomalous crystallographic relations.

The lecturer has proved that the substance supposed by Berzelius to be vanadium is not the metal, but an oxide, and that the true atomic weight of the metal is 51·3. The vanadic acid, VO_3, of Berzelius, hence, becomes V_2O_5, corresponding to P_2O_5, and As_2O_5; and the above-mentioned isomorphism is fully explained. The sub-oxide of Berzelius is a tri-oxide, V_2O_3; whilst the terchloride (VCl_3) of Berzelius is an oxychloride, $VOCl_3$, corresponding to oxychloride of phosphorus, $POCl_3$.

Professor Roscoe has succeeded in obtaining bromine and iodine compounds of vanadium, and also various metallic vanadates. He went on with his lecture by pointing out that the characters of the

[1] From the *Chemical News*.

vanadates bear out the analogy of the vanadic acid with the highest oxides of phosphorus and arsenic; and stated, in conclusion, that vanadium, hitherto standing in no definite relation to other elements, must now be regarded as a member of the well-known triad class of elementary substances, comprising nitrogen, phosphorus, boron, arsenic, antimony, and bismuth.

The president, in proposing a vote of thanks to the lecturer, called attention to the great service Professor Roscoe had rendered to chemical science by his successful investigation of vanadium.

After the delivery of this lecture, Professor Hofmann, from Berlin, favoured the society with a few observations on an organic body he had obtained by treating sulpho-urea with silver oxide. This substance, CH_2N_2, is distinguished by its great tendency to polymerize.

Dr. Hofmann further communicated that a compound isomeric with chloral had recently been discovered by two Berlin chemists. It differs from ordinary chloral by its much higher boiling point.

ANTHROPOLOGICAL SOCIETY OF LONDON.

April 19th.—Dr. Berthold Seemann, V.P., in the chair. John Colam, Esq., 105, Jermyn-street, St. James's; and David Mitchell Henderson, Esq., 1, Carden-place, Aberdeen, and Old Calabar, West Africa, were elected fellows. Dr. D. Luback, of Kampen, Holland, was elected a corresponding member.

A paper, by Mr. Alfred Sanders, was read "On Mr. Darwin's Hypothesis of Pangenesis as applied to the Faculty of Memory."—The first question to be asked was—Is thought a function of the brain? The author answered it in the affirmative, and cited facts and appearances in physiology, anatomy, pathology, and physics in support of his opinion. Thought could not be considered as a product of the brain-cells any more than light could be produced by the cells of the retina, yet the brain-cells were necessary for the communication between the mind and the external and internal world, and were exhausted in the process of thinking and willing in the same manner as the cells of the retina were exhausted and required renewal in the process of seeing. Passing to the consideration of the faculty of memory, the author combated the theory of Mr. John Stuart Mill, that the mind is a series of feelings and nothing more, and that memory is an ultimate fact incapable of explanation. The remainder of the paper was devoted to the application of Mr. Darwin's hypothesis of Pangenesis, which the author maintained was capable of explaining the difficulty raised by Mr. Mill; it being granted that the mental faculties depend upon the brain, and that the brain-cells give off self-propagating gemmules indefinitely, everything becomes plain. After describing in detail the action of external impressions on the brain at different times in the life of an individual, some of the many conditions favourable or the reverse to the retention of such impressions, and the dormant and active states of the brain-cells, the author entered into a consideration of the growth of the supposed gemmules, their action at maturity, and their power of self-propagation.

Mr. W. B. Kesteven supplemented the paper by a speech of some length in general support of Mr. Darwin's hypothesis, but not of its treatment by Mr. Sanders, and by the exhibition of a series of microscopic anatomical preparations in illustration of his remarks.

The discussion was further sustained by Dr. Langdon Down, Rev. Dunbar Heath, Mr. Dendy, Dr. Ellis, M. Robert Des Ruffières, Mr. George St. Clair, the chairman, and others.

Mr. George C. Thompson contributed a note on "Consanguineous Marriages," urging upon the society an investigation into the following questions:—1. When the defects commonly attributed to relationship of the parents are exhibited, are the germs of these defects traceable in the parents or their families? 2. When the medical pedigree of the parents is faultless are the children sound and healthy? 3. When any particular excellence occurs in the parents' family, is it transmitted to the children in increased force?

Dr. Langdon Down said that after an examination of some five thousand cases of interbreeding he had arrived at the conclusion that the practice was not only not necessarily injurious, but that a methodical and judicious selection in the marriage of close relations would be of enormous value to the community in the improved race of men that would by that means be obtained.

Capt. Blair cited in support of that view the case of a people on the Ganges, while other speakers adduced conflicting evidence.

EASTBOURNE NATURAL HISTORY SOCIETY.

The ordinary monthly meeting of this society was held in Lismore-road, on Friday, April 22nd. About 50 members and visitors were present, among whom were Messrs. T. Ryle, C. J. Muller, F. W. H. Cavendish, J. G. Morison, R. Podmore, J. T. Carleton Stiff, Dr. and Mrs. Allnatt, Dr. and Mrs. Hayman, Major Garrard, Miss Hall, the Misses Hood, Miss Woodhouse, Miss Agnes Walker, Miss Burnell, &c.

In the absence of the president, the chair was taken by Mr. Ryle. The minutes of the previous meeting having been read, the secretary announced that Miss Hall and Miss Woodhouse, had kindly commenced forming a collection of Eastbourne plants for the museum of the society, and would be glad to receive good specimens from any members to add to it.

The chairman then called upon Dr. Allnatt to read his paper "On Ozone and Antozone." This paper was of considerable length and interest, and we purpose to publish it in full among our articles in an early number.

Dr. Allnatt exhibited a series of beautiful tests, coloured by the atmosphere, elucidating the influence of ozone and antozone.

A paper by Miss Hall, on "Caddis-Worms and their Cases," and some particulars of a beautiful but most scarce fish recently found here, by F. C. S. Roper, Esq., F.L.S., were also read at this meeting.

The several contributors of these interesting papers received the unanimous thanks of the society.

BRISTOL MICROSCOPICAL SOCIETY.

April 27th.—Mr. W. J. Fedden, president, in the chair. The minutes of the two preceding meetings were read and confirmed, and two new members were proposed for election. Dr. H. E. Fripp then exhibited and described a series of anatomical preparations chiefly illustrative of diseased conditions of the brain tissues.

GLASGOW NATURAL HISTORY SOCIETY.

The eighth meeting of the session was held on Tuesday evening, the 26th April, in the library of Anderson's University, Professor John Young, M.D., president, occupying the chair. Messrs. James Hardy, Old Cambus, Berwickshire, and Mr. James Thomson, Kelvingrove House, West End Park, were elected corresponding members of the society.

Dr. Young exhibited a model illustrating the anatomy of the Polyzoa, recently prepared for the Hunterian Museum by Mr. Fenwick, and made some remarks on the value of such models for teaching purposes.

Mr. John Young exhibited a series of specimens of a rare bivalve shell, first discovered by Mr. James Thomson, a member of this society, in carboniferous limestone strata in a locality near Dalry, Ayrshire, and which has since been named *Anomia corrugata*, n. sp., by Mr. Etheridge, of the Jermyn Street Museum, London. Mr. Young stated that he has recently obtained specimens of this interesting shell in a second and new locality, at a quarry near Boghead, south-west of Hamilton, and made some remarks on Mr. Thomson's discovery as the earliest recorded example of the genus Anomia found in this country.

The following papers were then read:—

"Note on the recent occurrence of the Crane (*Grus cinerea*) in Ross-shire," by the Secretary.—Mr. Gray stated that he had examined a young male bird of this species in Dingwall ten days ago, which had been shot on the Dundonnell estate, near the head of Loch Broom, on the West Coast, and that a second specimen had been seen and shot at by a keeper at Loch Torridon, in the last week of March. Mr. Gray also read a communication to the meeting from Mr. Wilson, of Kirkcaldy, on the occurrence of a male Golden Oriole (*Oriolus galbula*), which was shot on the estate of Raith, in Fifeshire, on the 23rd of last month.

"Notes on recently determined Foraminifera from the Lanarkshire Coalfield," by Mr. John Young.—The author of this paper stated that he had submitted the specimens with which his remarks were illustrated to Mr. Henry B. Brady, F.L.S., Newcastle-on-Tyne, and that they had been found by him all to belong to new species, which he had named as follows:—*Textularia antiqua*, *Involutina lobata*, *I. radiata*, *I. conica*; one or two forms being left undetermined until further sections were made, so as to determine their exact relationship to some of the other fossil genera. Mr. Young also stated that previous to the recent researches made by himself and other members of the Natural History and Geological Societies of Glasgow, no Foraminifera had ever been recorded from the carboniferous rocks of the West of Scotland; but in the washing of certain of the weathered limestones and shales the above mentioned species had been found. Mr. Young next pointed out the vertical range and distribution of the species, the various localities and nature of the strata in which he had found these minute organisms, and recommended a more extended search for other forms; concluding his paper by remarking that the genus Involutina, which was once thought to be an essentially liassic type, was now declared by Mr. Brady to have its fullest and most characteristic developement in the carboniferous period.

"Notes on *Pleurobranchus plumula* (Montagu), with illustrative Specimen," by Mr. David Robertson, F.G.S., vice-president.—Mr. Robertson remarked that during the present month he had procured three or four specimens of this animal from the fishermen at Cumbrae,

who had found them in some numbers adhering to their lines brought up from deep water. Previously, he had looked upon the species as rare in that locality, having obtained only two specimens in all his experience there.

The following donations to the library were then announced:—1. *Transactions and Proceedings of the Botanical Society of Edinburgh*, vol. x. part 1—from the society. 2. *Transactions of the Geological Society of Glasgow*, vol. iii. part 2—from the society. 3. *Memoirs of the Wernerian Society*, vols. vi. vii. and part 1, vol. viii.—from the Royal Physical Society.

HALIFAX INSTITUTE OF NATURAL SCIENCE, NOVA SCOTIA.

Monthly Meeting, April 11th.—J. Matthew Jones, Esq., F.L.S., president, in the chair. Dr. J. B. Gilpin read a paper "On the Musquash (*Fiber zibethicus*)."—He gave a particular description of the animal, noticing the singular formation of the hind feet, which, from the toes being so densely clothed with stiffened hairs on either side, are rendered especially useful in swimming; the bristly hairs are stretched out horizontally when the hind feet press the water, and lap down when the feet are drawn towards the body again. Regarding the habits of the musquash, the following interesting remarks were made:—

The night is his special time for seeking food, for pastime, or for repairing his house, making holes, &c. As the eve of a summer's day closes in, the surface of almost any retired forest lake seems entirely broken up by their ceaseless gambols. Pursuing each other round and round, stopping to bite off a green rush, diving or throwing themselves entirely on one side, and so floating along. In this position they use but one leg. As regards food the musquash is a vegetable feeder, eating the bull-rushes, arrow-head, sweet flag, blue iris, and water lily. At times he visits the meadows adjacent to his aquatic home and eats the imparted Timothy grass in preference to the native "red top" and "blue joint." He will also cut off the stems of young wheat, sprawling over and tangling more than he eats. The mouths of his runs are frequently paved with the shells of fresh-water clams (*Unio*). The musquash will, at times, collect a mass of vegetable food and float it down stream. A young friend, who was watching for ducks up one of our pleasant rivulets, saw a female musquash coming down stream, pushing before her a raft of green bulrushes, and well packed. On my suggesting that she was building her nest, he observed, "It is only summer time, they don't build till the fall; she is getting food for her little ones." My son lately opened one of their houses, situate on Lake Winslow, about twenty yards from the shore. The depth of water about the nest was 2 ft. 3 in. The height of the house above the water was 1 ft. 7 in., and its circumference at the water's edge about 12 ft. On pulling it to pieces the upper room was found to be about 6 in. below the top and made up of soft dry hay, the roof being water-tight. The materials of the whole house were sedges, rushes, grass, sticks, and hay.

"On some Marine Invertebrates of Nova Scotia," by the President, who, in alluding to the Tunicata, thus described *Boltenia clavata*:—On carefully examining a specimen in my collection, preserved in alcohol, I am enabled to offer the following particulars:—Length of sac, 2 in. 2 lines; breadth of ditto, 1 in. 5 lines; length of peduncle or stem, 9 in. On opening the peduncle from sac to base, I found it hollow the entire length, excepting, perhaps, half an inch immediate to the root itself, which is composed entirely of fibrous cords, traversing and interlacing each other, and, in some parts, forming a solid mass, particularly at the base. On careful search, I could discover no communication between this hollow stem and the sac. Traversing what may be termed the dorsal region of the peduncle, I found a fibrous or muscular cord continuous throughout its length, evidently serving the purpose of a vertebral column. It was hollow for about half an inch from the sac, and communicated with its interior. As regards this muscular column, it is probable that it can be stiffened or relaxed at the will of the creature, and that in either case to enable it to bend its sac to the surrounding sea-bottom, or keep erect. The peduncle is wholly ramified by muscular fibre, which evidently gives it the peculiar toughness which characterizes it. The sac also is of a leathery consistence, but more delicate in appearance, although thicker and equally tough.

On the stem of one of my specimens, which was brought up from a depth of about one hundred fathoms, eighty miles east of Cape Breton, there exists an abundant parasitic growth, among which a Polyzoan of the genus Cellepora is very prominent, encrusting the stem and adhering to the seaweed which also clothes it. Minute specimens of *Saxicava rugosa* are inclosed here and there in the cellepore mass, and at intervals a small and handsome coralline occurs. I also obtained several Rhizopods, all belonging apparently to one genus, the Nonionina of D'Orb.

Judging from specimens of Boltenia in my collection, I imagine that the parasitic growth exists in greater or less profusion, according to the age of the invertebrate, as one example has its peduncle hardened and woody, as if past its prime, and the cellepore which forms a complete crust around it is dead at the base, and its surface is smoothed precisely like aged coral at the base of a recent growth.

The geographical distribution of *B. clavata* on the east coast of America appears to extend from New York to the Arctic regions, as it has been taken off the New York shore; on that of Massachusetts; at Grand Manan, Bay of Fundy; in the Straits of Belleisle, Labrador; and in Greenland.

BOSTON (U.S.) SOCIETY OF NATURAL HISTORY.

March 16th.—Mr. William T. Brigham in the chair. Fourteen persons present. The following papers were presented:—"Note on the Occurrence of *Euleptorhamphus longirostris* on the Coast of Massachusetts," by F. W. Putnam.—Dr. Günther, in his valuable *Catalogue of the Fishes of the British Museum*, admits five distinct forms under the genus Hemirhamphus, which had been considered as genera by other authors. While fully agreeing with Dr. Günther that the teeth are too rudimentary in this sub-family to warrant the establishment of genera based on them alone, yet the characters afforded by the head, body, and fins, appear to be sufficient to establish these groups as genera. At all events there seems to me no reason to question the generic rank of the group now under consideration; for their elongated, slender, and narrowed bodies, long pectorals, short ventrals, and elongated heads, give them an appearance nearly as marked from the typical *Hemirhamphus Brasiliensis* as is Exocœtus.

Prof. Valenciennes has described two species of Hemirhamphus with very long under jaws, long bodies, and long pectorals. One of these was figured by Russell, and afterwards, from a specimen received from the Bay of Bengal, by Valenciennes, in the illustrated edition of the *Règne Animal*, under the name of *H. longirostris*, as at that time it was the only species known having an exceedingly long jaw. In the *Histoire Naturelle des Poissons*, a second species, obtained at De Peyster's Islands (South Pacific), with a still longer under jaw, is figured and described under the name of *H. macrorhynchus*.

In 1859 Prof. Gill founded the genus Euleptorhamphus for a species of Hemirhamphinæ, with tricuspidate teeth in the lower jaw. He compares the specimen (the locality unknown) which he names *E. Brevoortii*, with *H. macrorhynchus* and *H. longirostris*, to which he acknowledges it to be very closely allied; but as the character of the teeth in his specimen differed from that given as existing in the two allied species, he felt warranted in considering his fish not only as a distinct species, but also as the type of a new genus.

In September, 1869, Francis Gardner, Esq., of Boston, presented to the Peabody Academy of Science a fish caught a few days previously by Mr. Agustus Welcome, a fisherman at Nantucket, while fishing with a number of others off the island. None of the fishermen on the island had ever seen such a fish before, and it was given to Mr. Gardner on condition that a name and some account of it should be sent to Mr. Welcome. At the first examination I felt sure that this species was either *H. longirostris*, Val., or a closely allied species. And on looking over the collection in the Academy, I was still further surprised to find two specimens of a closely allied species,—one from Cayenne, Guiana, presented several years since to the Essex Institute by Capt. J. Cheever, and the other without a label. These two specimens I now refer with but slight hesitation to *H. macrorhynchus* of Valenciennes.

A fourth specimen of the genus was discovered in the collection of the Boston Society of Natural History, but unfortunately was without a label indicating its locality. This specimen is unquestionably the same species as the one from Nantucket.

I have also hastily examined three specimens contained in the museum of comparative zoology, which were collected by Mr. Andrew Garrett at Hawaii, and am satisfied, as well as one can be without direct comparison of the specimens, that they are of the same species with the other specimens I have considered as *H. longirostris*.

The tricuspid teeth noticed by Prof. Gill in his *E. Brevoortii* do not seem to be of much importance, as one of the three specimens from Hawaii, in the museum of comparative zoology, has tricuspid teeth in the under jaw, while the other specimens, which do not otherwise differ from it, have simple conical teeth. The specimen from the Boston Society is specially interesting as exhibiting the back teeth of the under jaw with three points, while the front teeth are simple. I must remark, however, that I have not been able to detect tricuspid teeth in the two specimens I have considered as *H. macrorhynchus*, though as I have not found them in three of the specimens that I have indentified as *H. longirostris*, this character cannot be considered as even of specific importance.

The author then gave a summary of characters exhibiting those common to the two species, and showing how closely allied they are. The specimens are all nearly of the size of those figured by Valenciennes; the Nantucket specimen being a little smaller than his figure of *H. longirostris*, while the Cayenne and two of the Hawaiian specimens are a little longer than his *H. macrorhynchus*.

The author appends the following note:—Since communicating the above to the society, the invaluable *Zoological Record* of Dr.

Günther, for 1868 (just received in this country), has called my attention to the *Repertorio Fisico-Natural de la Isla de Cuba*, by Prof. Poey, in which, p. 383, he describes as new *Euleptorhamphus velox* from Cuba.

Prof. Poey compares his species with the figure and description of Valenciennes' *H. longirostris*, with which he states it to be very closely allied. He gives depth of body as contained ten and one third times in the length, and the diameter of the eye three and one half times in the head. Dorsal 19; anal 21. Teeth tricuspid.

These points, from the description of Poey, indicate his specimens to be intermediate between what I have considered above as *E. longirostris* and *E. macrorhynchus*, and strengthen my belief that there is only one known species of the genus.

"A Revision of the Classification of the Mollusca of Massachusetts," by W. H. Dall, Smithsonian Institution, was also a paper read, but the report of it has not yet reached us in full.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

PARIS, APRIL 25TH.—M. Faye addressed the meeting with regard to a work recently published in Germany, on the advantages to be gained by the use of photography in observing certain astronomical phenomena, such as eclipses, occultations, and, in the present instance, for observing the approaching transit of Venus. The advantages of the photographic method were recognized by him eighteen years ago. He said he was glad to see that foreign astronomers were about making use of this method, and he recommended it again to the astronomers of the Observatory and of the Bureau of Longitudes. M. Faye also mentioned a work published at Rome by M. Respighi, on the results of a great number of observations on the protuberances of the sun made by following the method indicated by M. Janssen. An interesting fact which results from the whole of these observations, which are rather numerous, is that, in the part N.N.E. and S.S.W. of the sun, the protuberances are scarcely apparent. In general, they are not visible at either of the poles up to about 20°; whilst, on the contrary, they are very numerous towards the latitude of 45°.

M. Faye then made some remarks on the causes to which the protuberances might be attributed. He considers the protuberances as direct emanations from the photosphere, projected from above the hydrogen layer which surrounds the sun by means of ascending currents. He thinks too that other descending currents drive these masses above the layer in which they appear, by virtue of a force which may be produced by the reaction of the photosphere on the hydrogen layer which surrounds it. Perhaps there is also an effect of the repulsive force attributed to the sun, the effects of which were supposed to be visible in the fact that the tails of comets are always in an opposite direction to the sun.

M. Cahours then brought forward a book written by him in conjunction with M. H. Gal, on the new platinum derivatives of the phosphorus bases. There is found in the animal world, but disseminated in different organs and secretions, a substance discovered for the first time by M. Strecker in the bile, and by M. Liebreich in the brain, and given by them the names of *choline* and *nevrine* in order to indicate its origin. M. Wurtz proved two years ago that this substance can be artificially produced by acting on trimethylamine with chlorhydride of glycol. The work presented by M. Cahours dealt generally with the further development of the subject.

M. Liouville announced the discovery at Marseilles, by M. Borelli, of a new small planet which is the 110th in the series of asteroids already known which revolve between Mars and Jupiter; this discovery was made on the 19th of April. M. Borelli having begged M. Delaunay to give a name to this new planet, he gave it that of Lydia.

M. Henri Sainte-Claire-Deville presented a memoir by M. Alfred Ditte containing the details of researches relative to iodic acid made at the Laboratory of the Normal School. M. H. Sainte-Claire-Deville also presented a note on the emulsion of liquids.

M. Béchamp read a paper on the presence of numerous organisms in various specimens of chalk.

M. Bonafont then read a paper on his new apparatus for the treatment of diseases of the middle ear.

After this a communication was made by M. Tremblay on the necessity of organizing a maritime protection system on all the coasts.

The meeting was brought to a close with a paper by M. Croullebois on the variations of the index of refraction of water according to the temperature.

THE VIENNA ACADEMY.

MARCH 17TH.—Prof. Von Graber presented a memoir on the similarity in structure of the external female sexual organs in the Locustidæ and Acridia on the ground of their development.

March 24th.—Prof. J. Stefan presented a preliminary communication on a new experimental method of analyzing the motion of resounding columns of air, by Professors A. Toepler and L. Boltzmann.

A communication was made also by Prof. Stefan on some researches on the excitement of longitudinal vibrations by transverse ones.

Dr. A. Boué made some remarks on the accumulation of erratic blocks in the new red and tertiary sandstones or conglomerates.

Prof. Brücke presented a memoir, entitled, "On the Physiological Signification of the Breaking up of Fat in the Small Intestine." He points out that the broken up fatty acids—broken up by the action of the pancreatic juice, and combined with alkalies as soaps—facilitate in a marked degree the emulsification, and at the same time the absorption, of the undecomposed fat.

Dr. S. Stern presented a memoir on the resonance of unconfined air, a contribution to the theory of sound.

NOTES AND MEMORANDA.

University of London.—The following have been appointed Examiners or Assistant-Examiners for 1870-71:—Classics—Rev. Hubert Ashton Holden, LL.D., M.A., and F. A. Paley, M.A. The English Language, Literature, and History—J. G. Fitch, M.A., and Professor Morley. The French Language—Professor C. Cassal, LL.D., and Gustave Masson, B.A. The German Language—Frederick Althaus, Ph.D., and Reinhold Rost, Ph.D. The Hebrew Text of the Old Testament, the Greek Text of the New Testament, the Evidences of the Christian Religion, and Scripture History—Rev. Samuel Davidson, D.D., LL.D., and Rev. J. J. Stewart Perowne, B.D. Logic and Moral Philosophy—Rev. Mark Pattison, B.D., and Professor G. Croom Robertson, M.A. Political Economy—Professor W. Stanley Jevons, M.A., and Professor T. E. Cliffe Leslie, LL.B. Mathematics and Natural Philosophy—Professor H. J. S. Smith, M.A., F.R.S., and Professor Sylvester, M.A., F.R.S. Experimental Philosophy—Professor W. G. Adams, M.A., and Professor G. Carey Foster, B.A., F.R.S. Chemistry—Dr. Matthiessen, F.R.S., and Professor Odling, M.B., F.R.S. Botany and Vegetable Physiology—Joseph Dalton Hooker, M.D., LL.D., F.R.S., and Thomas Thomson, M.D., F.R.S. Geology and Palæontology—Professor Duncan, M.B., F.R.S., and Professor Morris, F.G.S. Law and the Principles of Legislation—James Bryce, B.C.L., and Thomas Erskine Holland, M.A. Practice of Medicine—John Syer Bristowe, M.D., and Professor J. Russell Reynolds, M.D., F.R.S. Surgery—Professor John Birkett, F.R.C.S., and F. Le Gros Clark, F.R.C.S. Anatomy—Professor William Turner, M.B., and Professor John Wood, F.R.C.S. Physiology, Comparative Anatomy, and Zoology—Michael Foster, M.D., and Henry Power, M.B. Obstetric Medicine—Robert Barnes, M.D., and Professor W. M. Graily Hewitt, M.D. Materia Medica and Pharmaceutical Chemistry—Thomas R. Fraser, M.D., and Professor Alfred Baring Garrod, M.D., F.R.S. Forensic Medicine—E. Headlam Greenhow, M.D., and Thomas Stevenson, M.D.

Discovery of an Underground Dwelling in Ireland.—A curious discovery, says the *Builder*, has been made on the farm of Kilourt, about two miles from Malin Head. While two men were raising a stone, they found a large opening underneath. To the south of the opening there seems to have been a refuse-room, which is about 10 ft. in length, and filled with limpet-shells, beef-bones, and ashes. North-west from the entrance is an apartment 12 ft. long by 9 ft. wide, and 5 ft. high; at the end of which is a small round hole cut in the rock, just large enough to creep through, which leads by a passage, 50 ft. long by 3 ft. wide, into a fourth apartment, running with a kind of curve, and 20 ft. by 6 ft. Passing through this, the fifth division seems to have been a kind of water-room, with a clear spring in one end of it. The room is 12 ft. long, 9 ft. wide, and 6 ft. high. To the left is a kind of cellar by 3 ft. of a drop, the entrance of which is very small; but the cellar is 45 ft. long and 5 ft. wide, at the end of which is another entrance built up with a shore stone.

Description of Browning's Automatic Spectroscope.—This instrument is thus described in the *Chemical News*:—It is furnished with a battery of six equilateral prisms of dense flint glass; all the prisms are joined together like a chain by their respective corners, the bases being in this manner linked together. This chain of prisms is then bent round so as to form a circle with the apices outwards; the centre of the base of each prism is attached to a radial rod. All these rods pass through a common centre. The prism nearest the collimator, *i.e.*, the first prism of the train, is a fixture. The movement of the other prisms is then in the proportion of 1, 2, 3, 4, and 5, the last or 6th prism moving five times the amount of the second. All these motions are communicated by the simple revolution of the micrometer screw which is used for measuring the position of the lines in the spectrum, and the amount of motion of each, and of the telescope, is so arranged that

the prisms are automatically adjusted to the minimum angle of deviation for the ray under examination. It is easy to test the efficiency of the instrument in this respect. On taking the lens out of the eye-piece of the telescope, the whole field of view is found to be filled with the light of the colour of that portion of the spectrum which the observer wishes to examine; while in a spectroscope of the usual construction, at the extreme ends of the spectrum, just where the light is most required, only a lens-shaped line of light would be found in the field of view. As a consequence of this peculiarity, the violet and deep red ends of the spectrum are greatly elongated, or rather much more of them can be seen than in an ordinary spectroscope, and the H lines, which are generally seen only with difficulty, come out in a marked manner.

SCIENTIFIC DIARY.

WEDNESDAY, May 4th.

Society of Arts, 8 p.m. Coversazione at South Kensington Museum.
Obstetrical Society. 7 p.m., Special Council Meeting. 8 p.m., "On some Temperature Variations in Diseases of Children," by Dr. W. Squire. And other papers by Dr. Brunton and Dr. Wynn Williams.

THURSDAY, 5th.

Royal Society, 8.30 p.m. Bakerian Lecture. Subject:—"On the Pre-Carboniferous Flora of North Eastern America, and more especially on that of the Erian (Devonian) Period," by Principal Dawson, F.R.S., of McGill College, Montreal.
Society of Antiquaries, 8.30 p.m. "Date of Discovery of American Continent, by John and Sebastian Cabot."
Linnean Society, 8 p.m.
Chemical Society, 8 p.m. "Vapour Densities," by Mr. J. T. Brown. "New Cornish Minerals," Prof. A. H Church.
Royal Society Club, 6 p.m.
Royal Institution, 3 p.m. "Electricity," by Professor Tyndall.
London Institution, 7.30 p.m.
Society of Artists and Amateurs, 8 p.m.
Harveian Society, 8 p.m.
Perthshire Society of Natural Science, 8.15 p.m. "The Botany of the North Inch." "Contributions towards the History of the Coleoptera (Beetles) of the District."

FRIDAY, 6th.

Royal Institution, 8 p.m. "Star-Grouping," &c., by Mr. Proctor.
Philological Society, 8.15 p.m. "Improvement of English Orthography," by Mr. D. P. Fry.
Archæological Institution, 4 p.m.
Geologists' Association, 8 p.m.
Western Medical and Surgical Society of London, 8 p.m. Nomination of Officers for the ensuing Session. Practical Evening for the Narration of Cases and Exhibition of Specimens.

SATURDAY, 7th.

Royal Institution, 3 p.m. "Astronomy of Comets," by Prof. Grant.
Geologists' Association. Excursion to Lewisham, Kent. Members to meet at Charing Cross Station, at 3 p.m.

SUNDAY, 8th.

Sunday Lecture Society, 8 p.m. "On the Prevention of Infectious Diseases, illustrated by the Sanitary Measures enforced in the City of Bristol," by Henry Moody, Esq.

MONDAY, 9th.

Royal Geographical Society, 8.30 p.m.
London Institution, 4 p.m.
Geologists' Association. Excursion to Swindon, Stroud, and Mayhill, for one day, two days, or three days. Members to travel by the 6 a.m., 6.50 a.m., or 9.15 a.m. trains from Paddington Station.
Royal Institution, 2 p.m. General Monthly Meeting.

TUESDAY, 10th.

Ethnological Society, 8 p.m. Special Meeting at the Museum of Practical Geology, opening Address by Professor Huxley. "On the Influence of the Norman Conquest on the Ethnology of Great Britain," by the Rev. Dr. Nicholas, M.A., F.G.S.
Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m.
Photographic Society, 8 p.m.
Royal Institution, 3 p.m. "Moral Philosophy," by Prof. Blackie.

WEDNESDAY, 11th.

Royal Microscopical Society, 8 p.m. "On a New Form of Stereoscopic Binocular," by Mr. Samuel Holmes.
Society of Arts, 8 p.m.
Geological Society, 8 p.m.
Royal Literary Fund, 3 p.m.
Royal Society of Literature, 4.15 p.m.
Archæological Association, 8 p.m.

GUNDLACH'S OBJECTIVES.—"H. C."—We regret that owing to the many demands on our time we cannot comply with our correspondent's request. Gundlach's English agent is Mr. Winspear, optician, Hull. If "H. C." will communicate with him the matter can be arranged. We believe it takes some weeks to procure a glass. Crouch, of London, is now making an excellent series of English cheap immersion object-glasses.

MUSEUM OF COMPARATIVE ZOOLOGY.—"R. B."—Our Massachusetts correspondent's communication reached us in due course. It should have been earlier acknowledged, but that it was mislaid.

SOLAR-SPOT MAXIMA PERIODS.—"A. E." must excuse our complying with his request. He had ample and abundant opportunities of enforcing his views. We do not think his reply to his opponent at all satisfactory, and as our space is much encroached on, we must decline his proposal. Had his MS. not been destroyed, we should have returned it, though it is quite against our custom to do so. We shall be happy to hear from "A. E." on other subjects, and we can assure him we are absolutely uninfluenced by any opinion save our own. "A. E." is ungenerous in his suspicions of his opponent.

"METEOROLOGICAL MAGAZINE."—"G. J. S."—It is to hand, and shall receive attention.

ERRORS OF NATURE.—"T. A. O."—We beg to thank you for your letter. We are familiar with many of Dr. B.'s experiments, and quite agree with him in his general conclusions. The *esprit de corps* of the press prevented our inserting the title sent. We could have supplemented your list to a very great extent—the carelessness of "reader," editor, and publisher is something "prodigious," as Dominie Sampson would say.

NOVA SCOTIA INSTITUTE.—"J. M. J." is heartily thanked for his enclosure. Let him send us the paper by all means. His request shall be laid before our publishers, as it refers to a commercial and not editorial—aspect of the journal.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.—"T. W. W."—The report is to hand. Explanation is quite satisfactory. The pamphlet has also reached us, and shall be duly noticed.

DUBLIN SCIENTIFIC SOCIETIES.—"A. W. F." is thanked. We shall be glad to receive the reports. We shall lay his proposal before the publishers.

THE UNIVERSITY OF LONDON.—"J. M."—We thank you for the "cutting." We could not, with a regard to our own interests, publish it. You will see, however, that we have referred to it in "The Week."

OZONE AND ANTOZONE.—"R. H. Allnatt."—Report received. If possible, the paper shall appear in full in this number. The meeting will be separately reported.

WOMEN AT THE UNIVERSITY OF EDINBURGH.—"Dr. L.'s" letter has been received. We are much obliged for his good esteem.

PROPAGATING THE LARCH FROM SEED.—"C. S." is thanked. We are, however, sorry that we cannot reproduce the papers sent. They are unsuitable.

DRESSING FEATHERS.—"R. G."—Samples received; also specimen of indigo. Both shall be noticed. Send us a very brief account of each.

NOTICES.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

Subscribers to SCIENTIFIC OPINION are informed that they can procure of the Publishers direct, or through their local Bookseller, neat cloth Cases for Binding Volumes I. and II. of this periodical, price 2s. each.

ALL persons failing to obtain a regular supply of this journal through their local agent may insure its prompt receipt upon the day of publication by forwarding their name and address to the publishers, at 75, Great Queen-street, together with a remittance in accordance with the subjoined modified scale of subscription (which includes postage), viz.—

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These terms practically abolish the charge for postage, and those of our readers who have hitherto been inconvenienced by the apathy or inattention of their newsagents will henceforth be saved trouble, annoyance, and extra cost in procuring this journal.

THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, MAY 11, 1870.

MR. PROCTOR ON STAR-DRIFT AND NEBULÆ.

THIS session's programme of Friday evenings at the Royal Institution was a brilliant one. It displayed a discrimination on the part of the Secretary which is highly to be commended, since it contained the announcement of a series of lectures well calculated to illustrate the most recent advance in different branches of Science. Indeed, in this respect, the Royal Institution has this year surpassed what it has achieved on former occasions, and has shown how useful a medium it may be for the popularization of scientific truth and discovery. But, amid the many interesting lectures which have already been or are yet to be given in the theatre at Albemarle-street, there is none more remarkable than the discourse which Mr. R. A. Proctor delivered to a most fashionable and attentive audience on Friday evening last. Whether we regard the striking novelty of the subject, the vast importance of the discoveries which the lecturer has lately recorded, the exquisite photographic maps used in illustration, the clear and exact sequence of Mr. Proctor's arguments in bringing a somewhat complex problem before a mixed audience, or, lastly, the forcible delivery of the lecturer, we are bound to confess that in every respect the discourse was one which reflected equal credit on the Institution and on the indefatigable astronomer whose name is associated with one of the most remarkable physical theories on record.

It was Mr. Proctor's difficult task to give a popular account of his very marvellous observations on two singular phenomena: (1) the tendency of the stars, even of individual constellations, to drift away through space in various directions, and with astonishing velocity; and (2) the wonderful fact that the nebulæ appear coincident with star-groups to an extent which demands some special explanation. It was no easy matter to demonstrate these points in the brief course of one hour's lecture, and further to justify the hypothesis which explains the second phenomenon. Yet it seems to us that Mr. Proctor went very far toward convincing his audience on all the points he undertook to discuss. We willingly admit that some of his ideas in connection with the relation between the brilliancy of certain stars and the proximity of nebulæ in the southern hemisphere, were unsatisfactory; but we may readily imagine that with more time at his disposal, Mr Proctor would have gone farther to demonstrate his opinions on this subject. But, in so far as concerns the two other problems stated and the theory of nebular attraction, which hinges on the second of them, there is, to our mind, nothing to overthrow the lecturer's propositions. If anything could better carry conviction to the minds of those unbiassed by previously-cherished doctrines, it was the admirable series of photographed star maps which, by means of the electric lantern, Mr. Proctor exhibited on Friday night last. As one or two of them passed in succession before our eyes, it seemed as though they might be educed in support of other hypotheses than those promulgated on the occasion. But as others followed, it became clear that the lecturer kept his best forces in reserve, for it was impossible to avoid perceiving the tendency of the stars *en masse* to drift toward one hemisphere from the other, and also the singular manner in which the nebulæ became grouped round certain clusters or constellations. The fact that in some of the more strongly marked nebulæ the stars were almost exclusively confined to the area of milky matter, leaving great blank rifts of stellar space-darkness; and further, that stars of marked brilliancy were frequently associated with the nuclear parts of the nebulæ, were points too strongly in favour of Mr. Proctor's notions not to be seized by even the best initiated in astronomy; and if we may judge from the way in which these were received by the audience, Mr. Proctor must be highly gratified with the result.

The photographs which Mr. Proctor exhibited correspond, we presume, with some of the new maps he and Mr. Brothers are about to publish; and, if so, we cannot but say that the astronomical world has a rare treat in store for it. A few of the absurdities of the older terminology have judiciously been excised, and a plan of arrangement has been adopted which enables the amateur to study the constellations easily, and yet with accuracy; and thus, once more, Mr. Proctor has triumphed, not only as an original observer of persevering enterprise and surprising acuteness, but as one of the best popular teachers of astronomy which the century has produced.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

A CONTEMPORARY, which takes a pride in its accuracy with reference to matters of scientific news, has stated without qualification that Professor Agassiz is still seriously ill. As this rumour may distress some of the professor's numerous friends in this country, we think it well to state that it must be accepted with considerable modification. Our American correspondent, writing from Cambridge, Massachusetts, U.S., under date of the 21st ult., informs us that the professor is "recovering from his long and serious illness. He is able to walk out a little on pleasant days, though still very weak." This is better news than that of our contemporary's.

AT the meeting of the Royal Society on Thursday, announcement was made of the following list of fifteen names of candidates selected from the total number of fifty-three whom the council recommend for election, viz.:—William Froude, C.E.; E. H. Greenhow, M.D.; J. Jago, M.D.; N. Story-Maskelyne, M.A.; M. T. Masters, M.D.; Professor A. Newton, M.A.; Andrew Noble; Captain Sherard Osborne, R.N.; Rev. S. Parkinson, B.D.; Captain R. M. Parsons, R.E.; W. H. Ransome, M.D.; Robert H. Scott; G. F. Verdon, C.B.; A. Voelcker, Ph.D.; S. Wilks, M.D. The election is fixed for June 2nd.

ON Saturday last the members of the Geologists' Association and students of University College, accompanied by Professor J. Morris, visited Lewisham and the neighbourhood, a classical locality for the study of Tertiary geology. The beds exposed at the brick-pits exhibit the white chalk with its cover of green-coated flints, overlaid by the ash-coloured Thanet sands of marine origin, and these succeeded by beds of rolled pebbles and clay, over which occur the fluvio-marine strata of the Woolwich series, consisting of beds of cyrena, melania, &c. with an intercalated bed of oysters; over these are clays with leaves, lignite and carbonaceous layers, with fragments of wood pierced by the teredo, and much iron pyrites and selenite. Above these fluviatile strata is a bed of pebbles, at the base of the marine deposit of the London clay with its characteristic septaria. The surface features of the district were also noticed as due to the nature of the strata, the faultings, and subsequent denudation they have undergone. These excursions of Professor Morris's have now become deservedly popular, and we cannot offer our geological readers better advice than to join one of them at the earliest opportunity.

WE learn from our contemporary the *Engineer* that Mr. Charles Dion, of New York, proposes to place an apparatus on

board of steamers and other vessels, so arranged as to sound an alarm on approaching the vicinity of an iceberg. The device is arranged on the bottom of the vessel, and is of such a nature that when the keel strikes any very cold stratum of water the alarm is sounded. It is well known that icebergs refrigerate the water around them to a considerable distance. Mr. Dion's instrument will exhibit the exact temperature of the water below the vessel at all times, and may prevent such dire calamities as that which befel the *City of Boston* steamer, supposed to have been destroyed by floating ice.

A PETITION is now being handed about for signature, asking that, in future legislation, facilities may be afforded for the admission of women on equal terms with men to medical diplomas, and to the means of medical education. We cannot help thinking that in taking this step the strong-minded women of these days are justifying the *Saturday Review's* epithet of the "Shrieking Sisterhood."

A SOCIETY, termed the Royal Geological Society of Italy, has been recently established under the auspices of the Minister of Agriculture, Industry, and Commerce, and has for its object the detailed investigation of the geological structure of the country as bearing upon its industry, and the preparation of a geological map. It is under the direction of Professor J. Cocchi (President), Professors Gastoldi and Meneghini, F. Giordano, Inspector of Mines, assisted by other Italian geologists. Three numbers of the Bulletin have been issued, the first containing both original articles and abstracts from other geological journals. The first number contains, besides the objects, rules, and arrangement of the Society, a notice of the geological structure of the Central Apennines, by Professor A. Zittel, of Munich, with a section showing the relation of the Macigno, Scaglia, and Fucoid schists to the underlying Neocomian, Tithonian, and Jurassic strata, and a comparative table of these formations of the Central Apennines with those of the Lombard and Venetian Alps, Northern Tyrol, and Tuscany. A short notice follows on the human remains found some years since on Cerboli, a small desert island between Tuscany and the Isle of Elba. The second and third numbers contain a long article on the stratified rocks of the Island of Elba, by Professor Cocchi, accompanied by sections showing the position of the iron ores; an abstract of a paper on the geology of the Lake of Lugano, by MM. Negri and Spreafico, and mineralogical notices by Professor Bechi on the composition of selagite, —Sp. gr. 3·15 H 2·5. Comp. SiO_2 40·8, Al_2O_3 22·1, Fe_2O_3 21·0, CaO 5·6, MgO 0·5, KO 6·9, Fl 0·8, H_2O 3·5.,—and of a Prehnitoid rock, both from Monte-catini, on Beryl from Elba, and black Tourmaline from the Island of Giglio. Besides these, there are abstracts of papers translated from other journals, "On the Marine Miocene Fauna of Upper and Central Italy," by Dr. Manzoni, and "On the Eruptive Rocks of the Tuscan Maremma," by G. vom Rath, as well as bibliographical notices of works bearing on the geology of Italy, and other short papers.

THE next meeting of the South London Photographic Society, which will be held on Thursday, will be devoted to the exhibition of photographs, and conversation thereon. Members and their friends are requested to attend, and to do all they can to make this little annual exhibition as interesting as heretofore.

THE general meeting of the Iron and Steel Institute will be held at the Westminster Palace Hotel to-day, under the presidency of the Duke of Devonshire. After the transaction of some routine business, the papers read by Mr. Menelaus, Mr. G. H. Benson, and Mr. T. Whitwell, at the December meeting, will be discussed. Mr. Charles M. Palmer will then read a paper on "Iron as a Material for Shipbuilding, and its Influence upon the Commerce and Armament of Nations." A paper will also be read by Mr. Gillott, of Normanton, on "Designing Rails." Both these papers will be open for discussion. In the evening the president and council will receive the members at the Westminster Palace Hotel. On Thursday the members and their friends will proceed down the river in a special steamer, for the purpose of inspecting the arsenal and gun factory. They will afterwards lunch at the Ship Tavern, Greenwich.

IT is reported, in the *Moniteur Belge* of the 30th ult., that Dr. Lordat, Honorary Professor of the University of Montpellier, has died there, at the advanced age of 98 years. The deceased took the degree of M.D., at the university just named, in 1797, and for a series of years he occupied the post of Doyen de la Faculté de Médecine, and was among the best teachers and the most expert medical practitioners that university has possessed. The deceased resigned his active duties some ten years ago, retaining the titles simply honorary. Dr. Lordat was a staunch supporter of the doctrine of *vis vitalis*, and adverse to the explanation of the phenomena of life by merely physical or chemical action. He has published a great many excellent medical works, and was (not only at Montpellier, but in the whole of Southern France) a physician whose aid and advice were esteemed of great value. His valuable library, including that of the late *savant*, Barthez, has been bequeathed by him to the Medical Faculty of the University above named.

DR. R. CARTER MOFFATT has published his address to the electors (trustees and managers) of the chair of Chemistry in Anderson's University. He seeks to obtain the post vacant by the death of the late Professor Penny, and refers to many claims which he possesses for the office in question.

THE Board of Trinity College, Dublin, by a decree dated the 19th of March last, has founded forty exhibitions, of the annual value of £25 each. These exhibitions are intended to aid deserving students in the prosecution of their undergraduate course, and will be awarded by competitive examination. They can be held for a term of two years, or less if the answering is not sufficiently good.

THE *Food Journal* gives some interesting statistics in reference to the food of the Belgian Miners. According to the reports, which it takes as authentic, the Belgian miners eat 2 lb. of bread per day, about 2 oz. of butter, 1 oz. of coffee and chicory mixed; while for dinner they have in the evening a portion of vegetables mixed with potatoes, weighing at the most 1½ lb. They have meat on Sundays and festivals, but during the week they drink neither beer nor other fermented liquors. Coffee is their only beverage. Yet these workmen are hardy and healthy. It is not the coffee which sustains them, for it constitutes but 1-35th of the nutritious properties of their aliment, though M. de Gasparin, in a paper read some years ago before the French Academy of Sciences, attempted to prove, from certain tables, that the waste in liquid excretion is less where coffee is drunk than at other times. The miners' coffee is not like the French *café au lait*, for it has but 1-10th part of milk in it; he drinks several pints in the day, and eats only bread and butter until the vegetable meal of the evening. The albuminous substance which enters into the rations of the Belgian miner is thus reduced from 23 grammes to 15 grammes of azote. This is less nutritious even than the diet of the monks of La Trappe at Aiguebelle. Here is, therefore, proof that life and health can exist throughout a whole population with less nutritive substance than is generally considered necessary.

THE annual conversazione of the Society of Arts came off on Wednesday evening last at the South Kensington Museum, and was in every respect a decided success. About 6,000 of the members and their friends were present. The company were received from eight till a quarter to ten by Lord Henry Lennox, M.P., chairman of Council. At ten o'clock their Royal Highnesses the Prince of Wales, President of the Society, and the Princess of Wales, attended by the Countess of Morton and Colonel Teesdale, arrived at the garden entrance

to the Museum, and were received by Lord Henry Lennox, M.P., chairman of Council, and other Vice-Presidents, members of Council, and officers of the Society. The Princess, escorted by Lord Henry Lennox, and followed by the Prince, who gave his arm to the Duchess of St. Alban's, then led the procession through the building by way of the South Court, the North Court, the Raphael Cartoon Gallery, the Sheepshanks' Galleries, and the Competition Gallery, to the Prince Consort's Gallery, which was especially set apart for their Royal Highnesses and their invited guests, and where they were received by their Serene Highnesses the Prince and Princess Edward of Saxe Weimar.

From Professor Frankland's "Report on the Quality of the Metropolitan Water-supply during the Month of April," it appears that the waters of all the companies were clear and transparent when drawn from the mains. The amount of solid impurities was much less than usual, probably owing to the remarkable absence of the customary April showers, which wash surface impurities into the rivers and streams.

At the meeting of the Highland and Agricultural Society of Scotland the other day, Mr. Menzies laid before the meeting a pamphlet entitled "Suggestions for Increasing the Supply of Spring Water at Malta, and Improving its Climate," by David Milne Home, LL.D., chairman of the Council of the Scottish Meteorological Society. In noticing the action taken by the Governments, &c., of different countries to encourage proprietors to plant woods, Mr. Milne Home thus notices the efforts made by the society:—"In Scotland, it having been considered desirable to encourage extensive planting for the sake of shelter, and also of providing useful timber, the Highland and Agricultural Society bestowed prizes, which commenced so far back as the year 1810, and still continue. These prizes have been of different kinds—sometimes several gold medals, yearly distributed, containing suitable inscriptions; sometimes pieces of plate, each of the value of ten guineas. These prizes are awarded to proprietors who have planted the largest quantity of trees of suitable kinds. The result has been to lead to the extension of forests, especially in the Highlands."

Two grand flower shows will be held at the Crystal Palace on Saturdays, May 21st and June 11th, to both of which will be added new features in the way of classes specially intended to encourage the skill of amateurs in the culture and arrangement of flowers. The annual Rose Show will be held on Saturday, June 25th, and a magnificent display of some thousands of roses in pots will be made by Mr. W. Paul, of Waltham Cross, in one of the corridors overlooking the grounds, from May 28th to June 4th. We learn also, from the *Gardeners' Chronicle*, that it is proposed to establish a society specially for the encouragement of the growth of florists' flowers. The new society is not intended to be in any way antagonistic to existing societies. Among the first things proposed is the restoration of the autumn show at the Crystal Palace. It is understood that the Directors of the Palace will give liberal assistance to the scheme. Those desirous of joining the society, or taking part in its operation, should address themselves to the Rev. H. H. Dombrain, Westwell Vicarage, Ashford, Kent.

The *Daily Telegraph* can hardly lay claim to being considered a scientific paper, but for all that, its writers might be assumed to be so far conversant with matters of science as "Dr. Brewer's Guide" or "Joyce's Scientific Dialogues" might enlighten them. We are, therefore, somewhat surprised at some remarks which appear in Monday's issue. In a short article, in which an accident is described which occurred to some peasants in Ireland, owing to their applying a light to a barrel of paraffin oil, the writer observes:—"It is quite possible that these 'natives' never saw mineral oil before, and they might have been pardoned for not expecting an explosion; but surely the *most ignorant peasant in Ireland must know that any oil will take fire from flame*, and that to bring a lighted splinter near the cask was, at least, to risk its total loss." We congratulate the *Daily Telegraph* on its latest achievement in physics. We certainly had no idea, till now, that "any oil will take fire from flame," but our contemporary is too well informed a journal to admit of any further doubt on our part!

Who first hit upon the idea of taking photographs in natural colours? This question is not unlikely to be discussed just now, as M. Niepce de St. Victor has passed from among us. An answer is partly given to it by M. Lacon, who, according to the *Photographic News*, makes the following statement:—In 1848 M. E. Becquerel discovered a means of producing the colours of the solar spectrum upon a silver plate prepared with chloride of silver. M. Niepce saw in *this fact* a realization of what he had *dreamt* of—the production of photographs in their natural colours. He took for the basis of his experiments the facts demonstrated by M. E. Becquerel, and founded upon them a series of researches and experiments upon coloured flames, which are, or should be, well known to the readers of photographic scientific literature.

Professor Laycock, in opening his summer class yesterday week, referred to the criticisms which had been made on certain of his remarks on the subject of medical education of women at the recent meeting of the University Council; and said that he had never stated that it was necessary to inquire into the moral character of any lady who had attended, or who in future might attend, the University as medical students, but that there were possibilities in the future that might render such an unpleasant, dangerous, and delicate proceeding necessary. As we last week published Professor Laycock's strictures on the proposed reform, we think it just to quote the above remarks also.

We believe that, after all, a limited number of press-tickets have been issued for a view of the ceremony of the inauguration of the new buildings of the University of London. The opening takes place to-day, and the arrangements for the occasion are as follows:—Visitors will be admitted into all the rooms except the Theatre and Senate-room. The latter will be reserved for the members of the Senate and their friends, but all ladies who have passed the examinations at the University, six or eight in number, will probably also be admitted. All doctors and masters of the faculties, being members of Convocation, who applied within the prescribed time, and also bachelors who graduated previously to 1856, will be accommodated in the Theatre. As many as 600 tickets have been issued to members of Convocation, and 550 to ladies. This being a State occasion, all graduates will appear in academical costume. On arrival at the University buildings, her Majesty will pass through the various rooms to the Theatre, where the Chancellor of the University will present an address, and refer to the foundation of the University, its objects and principles. The Prince and Princess of Wales and the Princess Louise are expected to be present; Mr. Gladstone, the President and two previous Presidents of the Board of Works, the Chancellor and Vice-Chancellor of every British university, the presidents of the six societies which are to be accommodated at Burlington House, the Presidents of the College of Physicians and the College of Surgeons, the Lord Mayor, and many other representative personages. The band of the Grenadier Guards will play during the morning, and it is expected that there will be a fine display of flowers from Kew Gardens. Visitors are requested to be in their seats as soon after ten o'clock as possible.

At a recent meeting of the Common Council of the City of London, Dr. Sanders moved the adoption of the report of a select committee, in relation to the erection of the new library and museum in Basinghall-street, for which the corporation passed a vote of £25,000. The report submitted for the approval of the Court plans, designs and model for the erection of the new library and museum, and recommended that proper

muniment rooms for the archives of the corporation should be provided in a portion of the basement of the building, at an estimated expense of not exceeding £2,500. The building could be utilized for the guests of the Lord Mayor upon state occasions, and thus they would save £19,000, which had been thrown away since the commencement of the present century. If the corporation were destined to be destroyed, they would have in the new library and museum another work of public utility and beauty to point to as the work of their hands. The motion was carried unanimously.

THE Bill incorporating the Industrial Exhibition Company, which was organized in New York to erect a permanent Crystal Palace, has passed the Assembly, and, having already passed the Senate, only requires the governor's signature to become a law. The project is one of great magnitude, and as the capital—seven millions—is said to be already paid up, promises to be brought rapidly to completion. It is said that the building is to be a permanent one, and after the exhibition is over will be devoted to the uses of a conservatory, botanical and zoological gardens, and to the general education of the masses.

WITH much pain we have to announce the death (owing to angina pectoris, complicated by organic disease) of Sir James Simpson, the late distinguished Professor of Midwifery in the University of Edinburgh. To Sir James belongs the merit of having introduced the administration of chloroform in cases of operation and parturition—in the latter, after much ecclesiastical opposition from a certain section of the Low Church. Sir James was not only a distinguished member of the profession, but was, in every sense of the word, a scientific man. His researches in archæology alone would have been sufficient to give him a very high status as a philosopher. In every sense of the word we may say of him, as of Wolsey, "He was a scholar, and a ripe and good one." Sir James was born in 1811, and was appointed in 1840 to the Professorship of Midwifery in the University of Edinburgh, for his discoveries in connection with chloroform, which are well known. Numerous honours were conferred upon him. Among these it may be mentioned that in 1853 he was elected Foreign Associate of the French Academy of Medicine; in 1856 he was awarded the Montyon Prize of 2,000f. by the French Academy of Sciences. About the same time he received the Knighthood of the Royal Order of St. Olaf, from King Oscar, of Sweden. In 1866 he was created a baronet; in the same year he received the honorary degree of D.C.L. from Oxford. In October last he was presented with the freedom of the city of Edinburgh, in "recognition of his scientific researches and applications of science to the alleviation of human suffering." The opening number of the new series of our contemporary, *The Period*, contains the following graceful epitaph:—

> "Through thee has often Death been captive ta'en
> By his twin brother. Thee the angels keep!
> Thou gavest us a new sleep in our pain,
> And thou hast passed to the old painless sleep."

THE observatory of Sir Isaac Newton being in the market for the comparatively small sum of 500 guineas, it is proposed, says the *Builder*, to raise that sum by public subscription, and present the building to the British nation either at South Kensington or elsewhere. Some American speculators are also said to be desirous of purchasing the observatory.

THE old buildings of the University of Glasgow ceased to exist for academic purposes on Friday, the 29th ult., when the winter session closed. The next session will open in the magnificent new edifice at Gilmore-hill, which has been erected at a cost of £250,000, of which, to the great credit of the Glaswegians, not more than £3,000 remains to be subscribed.

A SUM of about £990 has been raised for the Veitch memorial, and a general meeting of the subscribers will be held to receive the report of the central committee, and to determine finally on the application of the funds, as soon as the necessary arrangements can be completed. The *Gardeners' Chronicle* suggests that a day near the date of one of the principal exhibitions may be found convenient to subscribers who may wish to attend.

SIR THOMAS WATSON, who may be regarded as the father of the medical profession, is, we are glad to state, fast recovering from his last serious illness.

A MEETING, in reference to the Horticultural division of the forthcoming annual International Exhibitions, will take place on Friday, May 13, in the Council-room of the Royal Horticultural Society, when the attendance of exhibitors is especially requested. The Right Rev. the Lord Bishop of Winchester, Vice-President of the Society, will take the chair at twelve o'clock precisely.

L'Uomo nella Scienza is, according to the *Athenæum*, the title of Signor Stefanoni Luigi's translation of Herr Ludwig Büchner's recent work on *Man's Place in Science*.

A FINE work on European Spiders has just been issued at Upsala. Singularly enough, it is printed in English.

THE Commissioners of Sewers for the City of London are showing a worthy desire to solve the pavement-problem, especially as to the value of asphalt. More than two years since an admirable piece of granite pavement, fixed by asphalt, instead of by lime and sand, was laid in Duke-street, Smithfield, and the experience gained there seems to prove it to be the best adapted to sustain the heavy and severe traffic of the London streets. For two years it sustained the Holborn traffic, which now passes over the Viaduct, and not a single stone has shown the slightest appearance of wear or displacement. A further portion is now being laid down inside Temple-bar. The merits of asphalt pavement are, that it gives clean streets in winter by preventing the pumping-up of mud from between the stones, which the old system favours, and also prevents dust in summer by stopping up the source whence the dust comes. The sewers will also be relieved of an immense amount of solid *detritus* coming from this source. Asphalt being impervious to water, the bed will always keep dry and intact. Credit is due to Mr. Pedler for having brought it into use in London.

RELATIVE to the establishment of the new Physical Chair at Cambridge, a most important discussion was held on Saturday afternoon, at a meeting of the Senate in the Arts' School, upon the means of raising funds to meet the wants of the University and the Colleges, rather than between parties in the Senate. The want of more teaching of physical science has long been urged, and upon the recommendation of a Syndicate last year that a new chair should be founded and other appliances provided for this purpose, the Syndicate, whose report was discussed to-day, were appointed to consider mainly how the funds for this and other wants of the University were to be raised. They soon agreed that the funds could come only from the Colleges, and consequently a representative from every College was put upon the Syndicate; and they then sent round to all the Colleges a statement, unanimously signed, in which, after mentioning the inadequacy of the income of the University, they recited the recommendation of the Royal Commission (1852) that a "contribution should be made from the corporate funds of the several Colleges towards rendering the course of public teaching, as carried on by the University itself, more efficient and complete;" and the statute proposed to every College by the Executive Commission of 1856, though accepted by four only, providing for the payment to the University, so soon as the statute should be the law of all the Colleges, of 5 per cent. on the distributable income of each College, and urged a voluntary agreement for a scheme of contribution applicable to all Colleges. They proposed that the fund so raised should be held in trust for providing or increasing the stipends of certain professorships, under conditions as to election, residence, and the

delivery of lectures; for some subordinate teachers, buildings, apparatus, and other purposes connected with the public teaching of the University. They suggested three plans—Firstly, a contribution of 3 per cent. upon the distributable incomes of the Colleges; or secondly, one of 15 per cent. upon the annual incomes of such masters and fellows of Colleges as may be non-resident; or thirdly, 2 per cent. on the distributable income of the Colleges, and 3 per cent. on that of non-resident masters and fellows; and that the authority for such contributions could be had by an alteration of the College statutes with the consent of the Crown, or, if necessary, by an Act of Parliament. To this some Colleges gave an unconditional, others a more or less conditional, assent, and a minority dissented altogether. So, at the end of last term, the Syndicate reported to the Senate that they felt obliged to abandon the notion of obtaining funds from this source, and recommended an increase of 2s. in the capitation-tax on all members of the University, so as to provide for the professorship of Physical Science, and that the existing building funds should be charged with the capital expenditure needed for the laboratories, &c. This report was nominally under discussion, but really the whole question was reviewed, though no satisfactory result was arrived at.

A MEETING of the Royal Sanitary Commission was held the day before yesterday. Present: Right Hon. Sir C. B. Adderley, M.P., K.C.M.G., in the chair; Earl of Romney, Earl of Ducie, Right Hon. Lord R. Montagu, M.P., Right Hon. S. Cave, M.P., Lieut.-Colonel Ewart, C.B., R.E.; S. Whitbread, Esq., M.P., F. S. Powell, Esq., B. Shaw, Esq., J. Paget, Esq., F.R.S., J. Lambert, Esq., F. T. Bircham, Esq.; and the secretary, Mr. W. H. Birley.

MR. BRADSHAW, librarian of the University of Cambridge, has presented to the University some 5,000 books, pamphlets, and other pieces, relating to Ireland, collected by his father and by himself; and this valuable donation is given in the most liberal way, subject to no restrictions.

MR. R. H. ALLNUTT witnessed an aurora of unusual size and beauty at Eastbourne, on Saturday, at 9·30 p.m. A broad band of pale and vivid light extended throughout the whole length of the northern horizon, and trenched somewhat on its western boundary. There were no streamers and no coruscations, but the whole horizon was steadily illuminated by a persistent and brilliant phosphorescence. The wind blew cold and fresh from E.N.E., and atmospheric electricity was intense; the electrometer was almost equally sensitive to both the vitreous and resinous excitants. Ozone was scantily developed in earth's wind current; the test slip after considerable exposure to the atmosphere exhibited scarcely a trace of elemental reaction. To observers with an unobstructed horizon, this aurora must have been something beyond the usual mark in these latitudes.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

NEW LIVING CORALS.

BY PHILIP HENRY GOSSE, F.R.S.

THOSE who are interested in marine zoology have now an opportunity of enriching their aquaria with some new and interesting living corals. Mr. King, of Great Portland-street, has just returned from the south coast of France, bringing with him a stock of two species, which he obtained from an island-cavern there, at extreme low water. From specimens which he has submitted to me, I have little hesitation in pronouncing them both to be unknown, as living animals, and one (the finer by far of the two) to be as yet wholly undescribed. Before I proceed to describe them, however, I ought to say, that dwelling in the country, remote from museums, and with no opportunity of reference to the literature of the subject later than the fine work of MM. Milne-Edwards and J. Haime (*Hist. Nat. des Coralliaires*, 1857, I do so with some measure of reserve.

1. PARACYATHUS NOBILIS (Gosse). Specific character: Plates forming six unequal systems, of six imperfect cycles; palules lobed; calice elliptical.

Description.

Corallum.—Turbinate; massive; its height exceeding the greater diameter; *calice* elliptical; the axes (in an average specimen) as 3 to 4.

Ribs.—Very numerous and close-set; obsolete below; their edges serrulate; their surfaces studded with granules, which, anastomosing, give the semblance of numerous minute perforations of the *wall.*

Plates.—In six cycles, partly imperfect, and six unequal systems; both of the terminal, and one of the lateral, systems of the ellipse (in the specimen examined) having a sixth cycle; while the rest have five. All very close-set, slightly salient, thin, scarcely thickened exteriorly; the highest point of their edge just within the margin, whence the outline descends in a *nearly straight* line, with no sensible angle, to the *columella.* This edge is set with extremely delicate and close *serræ;* the surfaces finely granulate. The plates of the lower cycles are much more coarsely granulate and less compact than those of the first and second.

Columella.—Forming a compact horizontal table, occupying *almost half* of the whole area of the *calice;* its surface composed of a multitude of irregular foliations, everywhere anastomosing. The height of this tabular floor makes the cup shallow.

Palules.—Taking the form of very irregular lamellæ, undulate, and granulate, which, springing from the *columella,* join the plates of the third cycle, sending out lateral branches, which join those of the fourth cycle; those of the fifth and sixth have independent *palules.* The arrangement, however, is subject to great irregularity.

Dimensions of the largest examples I have seen.—Diameter of long axis, ·9 in.; of short axis, ·65 in.; height about 1 in.

N.B.—One of my examples is decidedly turbinate, having a narrowed neck above the expanded adherent base. Another is about uniformly thick throughout: this latter has, growing from its side in a curved direction upwards, one of turbinate form, of about half the usual size. All have the lower portion of the *corallum* exceedingly rough and eroded.

THE ANIMAL.

This is of striking gorgeousness and richness of colour, resembling a *Balanophyllia regia,* greatly magnified, but of even purer hues. The whole *disk* is bright orange-scarlet, from which, sensibly within the margin, a broad ring of *tentacles* of the most brilliant yellow, springs. These, in a contracted state, appear as a confused series of knobs, very irregular in size and form, looking like semi-collapsed leathern bags. When distended, however, they are seen to be quite oval in shape, about 50 in number, set in what may be considered two rows, but, from varying distension, apparently thrown into groups, so that the biserial arrangement can never be traced throughout. When examined with a lens, in full distension, their surface is exquisitely smooth; the colour distributed, not as in *Caryophyllia* and *Balanophyllia,* in oblong warts, but evenly, in minute dots, like the finest *stippling* of a miniature painting.

The foot of each *tentacle* is embraced by two curved lines of crimson, which approach each other without meeting, before and behind, exactly like those of *Sagartia pallida,* figured in *Actinol. Brit.* p. 78.

The *mouth* is a lengthened slit. *Lips,* furrowed longitudinally within. The common scarlet hue descends into the

stomach, so far as I have been able to trace it. The *mouth* is protrusile, but does not rise into a regular cone.

The *ribs* of the *corallum* are covered, in each of my examples, with a spongiose flesh (or a parasitic sponge), which is of a yellow hue, varied with dirty drab or clay-coloured patches.

So far as I have seen, this gorgeously-apparelled creature is much more sluggish and uniform than the other corals familiar to our aquaria; never assuming that condition of extreme distension of the soft tissues, which at times imparts to our *Caryophyllia* its exquisitely ethereal translucency. I have fed it, and have found the morsel slowly engulfed by the almost imperceptible protrusion of the lips, and their closing over it; but no very notable distension of the tissues followed.

2. HOPLANGIA DUROTRIX (Gosse). This species I described, so far as the skeleton was concerned, in *Actinol. Brit.* p. 338, from specimens dredged by Mr. King at Weymouth. His present examples, from the Mediterranean coast of France, seem to me indistinguishable from the former, save that the everted edge of the *epitheca* is scarcely, if at all manifest. All that I have now to add is a description of the ANIMAL, as we conventionally term the fleshy tissues.

Of this, however, there is very little to be said. In the ordinary condition the whole cup appears lined with an impalpable jelly, which, in younger examples, gradually deepens from invisibility at the margin to a full buff or fawn-colour in the centre; in mature specimens this hue is more dusky in tint. Two or three times, at remote intervals, I have seen, protruded from this surface, to a considerable distance beyond the level of the *corallum*, an indefinite number of (comparatively) large ovate bladders, composed of a membrane so exquisitely attenuate as to be absolutely colourless. These I presume to be *tentacles*.

Sometimes the yellow-brown *disk* is seen to be distinctly parted in the centre, and the rough projections of the *columella* are revealed through the orifice. If a very minute atom of food be at such times dropped into the cup, the lips presently close over it. These are all the phenomena, indicative of life, that I have been able to observe in the species; they are, indeed, indubitable, but must be confessed to be very evanescent and feeble.

The *dimensions* of the species somewhat exceed those at first assigned to it. In one or two examples the *corallum* reaches a diameter of ·2 in.

On the carpet-like calcareous expansion which surrounds a group, just at the base of one *corallum*, I observe a crowded group of very minute corals, each being not more than ·04 in. diameter. They have a perfect circular *wall*, six systems of *plates*, but only two cycles, the development having not proceeded beyond the second cycle. I presume these are very young examples of the same species, and I look upon them with much interest.

Postscript.—Since the above was in type, Mr. King has favoured me with other specimens from this fortunate *find* of his. It proves richer than I had supposed; for, on a very cursory examination, I see a new *Balanophyllia*, of a pea-green colour, and one (if not two) additional species of *Paracyathus*. These I may describe, if I have leisure, in a future paper.

P. H. G.

CHEMICAL INTENSITY OF SUNLIGHT.

FOR many years past Professor Roscoe, of Manchester, has devoted much attention to the measurement of the chemical intensity of light at different parts of the earth's surface and under varying conditions. At the outset these laborious and important researches were made in conjunction with Professor Bunsen, of Heidelberg; subsequently the matter was taken up in this country, and instruments constructed according to the plan of Professors Bunsen and Roscoe were set to work at Kew Observatory, where the registration of the chemical intensity of daylight has been chiefly carried on within the last few years.

Very recently Professor Roscoe and Mr. Thorpe have made a new series of determinations in the latitude of Lisbon, with the aid of the pendulum actinometer with its slip of sensitized paper, in a manner precisely similar to that employed at Kew, and have arrived at the following very interesting general results, which are confirmatory of those previously obtained by one of the authors:—

It is found that the intensity of diffused light of the sky—not that reflected from clouds—is proportional within certain limits to that of the sun itself. When the altitude of the sun is less than ten degrees above the horizon the chemical intensity of its light is practically nothing, while that reflected from the sky reaches a very appreciable quantity.

Again: the chemical intensity of the solar light is found steadily and regularly to increase with the sun's altitude, until the maximum is reached when the meridian is crossed. The reason for this obviously is that, as our great luminary pursues his apparent upward course in the heavens, his rays have to penetrate a less extent of the earth's absorbent atmosphere, until, at the zenith, the light has to pierce a layer of minimum thickness of this absorbent envelope. As the sun declines after noon, the same gradual loss of actinic power in its light is observed. It is found that, though the conditions of the atmosphere may vary, this increase and diminution of the intensity of the solar light is strictly proportional to the altitude of the sun.

One of the consequences of this law is of the deepest interest to photographers, more especially to those living under a cloudless sky, as it would only be necessary to determine the time of exposure of a print at one period of the day, and Professor Roscoe's table would then supply the necessary information as to exposure at any other hour while the sun was more than ten degrees above the horizon.

If we take the case of a carbon print. It would be necessary, in the first instance, to ascertain, once for all, the time required to obtain a good proof. A relative measure, and suitable for any day, would be obtained by determining the depth of tint which a piece of standard sensitized silver paper would take in the time required to produce a good carbon print at a given hour of the day. This silver-tinted paper, when fixed, would then form the standard. The time required on any given day, at the same hour, to colour a similar piece of silvered paper to the same tint, or a little beyond it, would thus be the printing-time for carbon films from negatives of similar density to the one used in the first instance.

If, then, the printing-time at say eight o'clock in the morning be known, Professor Roscoe's table would enable us to state the proportional decrease in time up to noon, and the increase after the sun had passed the meridian. Much of the uncertainty attending the use of sensitive pigmented gelatine films would then be avoided, and a peculiarly simple system of actinometry adopted.

Unfortunately, the prevalence of clouds in our atmosphere materially interferes with the application of the plan we have just sketched out in these latitudes, as, in addition to the solar light, we have a large amount of diffused light as variable in amount as the clouds themselves. But in countries nearer the equator the use of Professor Roscoe's table in the manner we have mentioned would prove of very considerable value.—*British Journal of Photography.*

Compensating Cabins for Prevention of Sea-sickness.—Mr. W. Brown, of St. Mary-street, Portsmouth, has patented the use of cabins hung on gimballs, to prevent sea-sickness. The notion is ingenious, but, the *Engineer* thinks, is not novel, and it leaves the question of the effects of pitching—the most efficient cause of sea-sickness—untouched; but surely if the berths were swung as is the compass, a nearly horizontal position would be obtained?

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From April 24th to 30th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Arabian Baboon (Cynocephalus hamadryas) ♀ ...	Eastern Africa.....	Presented by Charles Both, Esq.	Monkey-house
2 Senegal Parrots (Pœcephalus Senegalensis) ♂ & ♀	West Africa.....	Purchased.....	Parrot-house
2 Derbian Wallabys (Halmaturus derbianus) ♂ & ♀	Australia	Presented by the Rev. J. Climenson, F.Z.S.	Kangaroo-sheds
1 Mange's Dasyure (Dasyurus Maugæi)	Ditto.....	Presented by Mrs. Buckland	Anteater's House
1 Indian Python (Python molurus)	India.....	Received in Exchange.....	Reptile-house
1 Greater Sulphur-crested Cockatoo (Cacatua galerita)	Australia	Presented by Mrs. Blatchley	Parrot-house
1 Masked Parrakeet (Pyrrhulopsis personata).....	Feejee Islands	Purchased.....	Ditto
1 Ocelot (Felis pardalis) ♂.....	America	Presented by Capt. Bevis	Small Mammal House
1 Vulturine Guinea-fowl (Numida vulturina)	Zanzibar	Presented by Dr. John Kirk, C.M.Z.S....	Western Aviary
7 Hybrid Geese	.....	Presented by the Earl De la Warr	Top Yard
2 Vulpine Phalangers (Phalangista vulpina) ♀	Australia	Presented by Miss A. Absolon	Anteater's House
2 Lesser Black-backed Gulls (Larus fuscus)	British Islands.....	Presented by J. W. Vines, Esq.	Gull-pond
2 Porpoises (Phocæna communis)	British Seas	Presented by Dr. L. Ormerod	Seal Pond
12 Short-nosed Sea-horses (Hippocampus brevirostris)	.....	Purchased.....	Fish-house
1 Cretan Goat (Capra beden)	.....	Born in the Menagerie	Goat-sheds
1 Pig-tailed Monkey (Macacus nemestrinus)	North-East India...	Presented by Vincent H. Straker, Esq. ..	Monkey-house
1 Balearic Crowned Crane (Balearica pavonina)	N. and W. Africa...	Presented by Master G. B. Campbell ...	Eastern Aviary
1 West African Tantalus (Tantalus ibis)	West Africa.....	Ditto.....	Ditto
1 Orange-headed Conure (Conurus jendaya).....	South America.....	Purchased.....	Parrot-house
1 St. Helena Seed-eater (Crithagra butyracea).....	South Africa	Presented by James Dixon, Esq., F.Z.S.	Western Aviary
1 Common Canary (Crithagra canariensis)	Canary Islands.....	Ditto.....	Ditto
1 Pin-tailed Whydah-bird (Vidua principalis)	Africa	Ditto.....	Ditto

♂ Male. ♀ Female.

THE CHANNEL PASSAGE.—VESSELS AND PIERS.

BY VICE-ADMIRAL SIR EDWARD BELCHER, K.C.B.

THE subject to which I am about to direct attention is, principally, the proposal to connect England and France by continuous railway communication, the gap—that is, the Channel interval—being bridged by steamers fitted to receive and convey the trains across, and deliver them on to the rails on the French shore. And it is inferred, from their great size and beam—fitted also with heavy sponsons and paddles—that they will not roll deeply, and consequently tend to prevent that misery to weak stomachs—sea-sickness.

Now, as regards the rolling motion, I am not satisfied by assertion, when diametrically opposed to personal experience, seeing that the worst rolling affecting vessels engaged on Channel service, caused by waves set in motion by the whole western space of the Atlantic Ocean, causing, as seamen term it, merely "the deep but easy roll," is not reckoned as due to a gale, for with sufficient wind a vessel is steadied by canvas. The serious rolling is due to an opposite cause, the absence of the gale, when that unaccountable ground-swell which tumbles into the Bay of Biscay lift also at the limit of soundings in the English Channel, and rolls in successive waves home to the shores of France and England, even up to the Goodwin Sands.

To adduce an example of the inefficiency of beam to prevent heavy rolling, as 60 ft. in vessels ranging about 2,000 tons, in perfectly glassy calm, I may mention the following:—The Brest squadron anchored in 1812 in Cawsand Bay, before the breakwater was commenced. It consisted of various types. Thus, the *Ville de Paris* and *Abercrombie*, French; *San Josef*, Spanish; *Norge*, Danish; *Queen*, *Conquestador*, and *Magnificent*, English; lower yards and topmasts struck, riding at single anchor. It had blown heavily from S.S.W., and terrific long-jawed rollers set in. These vessels rolled fearfully, and it was asserted that the *Queen* and *Magnificent* rolled "keel out."

I then belonged to the *Abercrombie*, and being an invalid, in the captain's cabin, was lashed in two chairs at one of the ports, commanding a complete view of several ships, and especially of the *Magnificent*. The foam certainly warranted the conclusion, as nothing but the "keel awash" could have produced it.

This point, however, is immaterial. It will be said the vessels of that period were short, and deep rolling natural; yet it was rather increased, as in the case of H.M.S. *Rodney*, when Sir W. Symonds, at a much later period, increased the beam, tonnage, and draught; and, in 1823, we have proof of what heavy gales and rolling seas effected on the breakwater at Plymouth Sound.

I have had some experience in crossing dangerous bars attended by heavy following rollers; still the roll at good speed on the ship was far from agreeable, indeed, I must admit dangerous. My object is merely to show that heavy, deep, and quick rolling is a Channel difficulty, and not to be lightly despised; and that, in considering the fitness of vessels for this peculiar service, we must not fancy that a stroke of the pen or a paragraph in print rules the waves. It is our business, as pretty well tried seamen, to state what is our opinion on such matters belonging to our "craft"—what is the proper character of vessel fit for such service as contemplated; and more, whether this railway system, carried afloat, is either practicable or judicious, specially, too, as regards reasonable expense; what should be the form, size, and speed for the contemplated service; and, finally, the probability of success by any of the types offered; or if a variation, dispensing with the train system, using the present or improved harbours, or improved ships, might not equally meet the present difficulties.

I must at once observe that my own opinion, as far as safety, comfort, and freedom from that jarring, creaking, and straining, which tophamper, projections, numerous joints, gimcrack ornaments, and fastenings is concerned, the beautiful drawings which have come before me, bring to my mind no idea of peaceful repose, but rather that idea of Pandemonium which the agonies of one of our old line-of-battle ships forcibly brought to my recollection. Now what do we require for an hour's travel across the Channel? A vessel to carry us safely, and not offering us enjoyments not to be enjoyed—a structure which shall be the type of strength, smooth as the back of a whale, offering the least possible obstruction to wind or wave, and carrying a light pilot-tower on the summit; in fact, a type of our ugliest ironclad, the beauty *par excellence* of our present navy.

Our outline decided, the interior fittings, those of the simplest nature, succeed. To passengers who fancy the whale's back, I would offer just such enlarged accommodation as the *Cigar* ship had (85 ft. long by 8 ft. wide), by a light hurricane house

and rail inclosing the turret pilot-tower, the type, indeed, of a felting around the funnel of H.M.S. *Carron*, for surveying duties in bad weather.

The velocity proposed by the advocates for these rail-boats is 20 knots; that involves, under paddle or screw, no small amount of vibration; but sea-sickness is not the result of violent motion. It is, so to speak, barometrical, the action of the diaphragm (like the aneroid) rising and falling with the motion of the ship, and specially acting on the nerves when it is influenced by the sight.

For my own part, I plead guilty to being subject to sea-sickness, but varying with the size and quickness of motion, greatest in the ships of the line, less in a cutter. If carriages are to be embarked for the hour's passage, no individuals but those possessing sea-legs would care to quit their *poss* to enjoy the deck, or smoke their pipes under the lee of the pilot-tower. All fittings but those absolutely demanded obstruct the free circulation of air, inducing faintness and sea-sickness, and consequently should be avoided.

It should be borne in mind that, when we propose to construct great ships, to carry such great burdens as railways and their passengers and goods trains, we pass out of the range of depths afforded by the harbours now in use; and, therefore, if you construct vessels capable of carrying them, you are bound to meet the question of inability to enter at certain times of tide and under certain conditions of weather. It therefore follows that your vessel must not only be calculated to cross the Channel, but also, if necessity demands, be competent to take care of herself at sea, or to return your passengers, free from sea-sickness also, at a safe port. Now, looking to certain plans and models to which my attention has been drawn, I must remark that such absurd decorated craft, with all the paraphernalia copied from the boats engaged on the inland seas of the United States, are not fit types for our Channel service.

If the floating railway schemes are to prevail, I see no difficulty in meeting the demand for proper vessels, provided, as in our harbour defences, money is to be cast away freely in the construction of adequate harbours, and if those structures are adopted, I am prepared to meet ships as well as harbours of refuge, but I cannot shut my eyes to the risks and delay of stone piers. The disruption of the breakwater at Plymouth, January, 1823 (of which I hold in my hand a copy by Whidberg, addressed to Sir Isaac Coffin); solid cemented masonry of some ten years' settlement; and at a later date the works at Alderney, erroneously assigned to my proposals in 1842 (but absolutely void of truth, seeing that the scheme proposed by me was to be carried out at Ret harbour, on the opposite side of the island, by inland excavation similar to that since carried out at Cherbourg), all attest the difficulties to be surmounted, foundations in deep water and the surf to prevent or delay completion. But, before we proceed, as to the vessels fit to carry out this railway conjunction, and, moreover, to be impelled at a standard velocity to agree with railway time, of 20 knots or more, have satisfactory computations been made, not as to chamber practice on paper, but as to all dangers and difficulties of that wild sea, not in a smooth dock, but (as sea-sickness is imported into the question) to the absolute security of life and property on so small a draught as 5½ ft? The plan of Mr. Fowler, giving 13 ft., is nearer to reason. That would agree with my own dimensions of 400 ft. long by 60 beam, but nothing then to spare.

Before these rail-connecting vessels are built, it is incumbent to construct piers or harbours to receive them. And if those structures are to be carried out, we should execute them on the most economical yet certain plans, bearing in mind the probability of the very close supersession of their services by the tube tunnel or bridge of the future. At this present moment, I see too many difficulties to be mastered before success can be deemed, in either of the great plans, even to loom in the future. But having such perfect confidence in the rising talent of our engineers, I feel certain that eventually a more satisfactory mode will be triumphant, for that ugly term "impossibility" but whets the ardour of inventive faculty.

First, then, if the railway question prevails, we are prepared to provide a safe vessel fit to proceed, not merely across the Channel, but even beyond the narrow seas, should she be caught in one of our severe gales on a lee shore. On the other hand, if we are satisfied with the present harbours, with their present depth of water within, and determine to improve them at moderate outlay, then we are prepared with a vessel similar in all respects for the customary traffic at the less draught of 7 ft.

For extension of piers and adaptation of the same for the large boats we are also prepared.

And here I must observe that I underrate none of the schemes before the public as simple computations. But, as a seaman, I am satisfied that grief would come to any one of those proposed vessels unfitted and incompetent to perform full sea-work if driven into the Atlantic.

Starting, then, on the principle that it behoves us, first, to utilize and improve what we have before we cast our riches on a foreign shore, to be depreciated at no distant period by other yet more expensive undertakings, I fall back on the class of vessels which I have to propose. And, I may add, that, under any change of circumstances, the outlines, in relation to size and depth, will preserve their features, the form being that of an ovoidal box, smooth from end to end, the terminal points being open to receive railway carriages of 8 ft. in width.

The following dimensions show the three classes:—

No. 1 ..... 13 ft.
„ 2 ..... 10 ft.
„ 3 ..... 7 ft.

CHANNEL SERVICE STEAMERS.—MAIL RAILWAY SERVICE.

13 ft. Draught.		10 Feet.	7 Feet.
Length	400 ft.	350 ft.	300 ft.
Draught.....	13 ft.	10 ft.	7 ft.
Beam	60 ft.	50 ft.	45 ft.
Displacement	4,000 tons	3,000 tons.	1,600 tons.
Indicated H.P.	8,000 tons	5,000 tons.	3,500 tons.
Speed.....	18 to 20 knots	20 knots.	20 knots
Draught	13 ft.		
Keel to deck.....	23 ft.	With one line	No rails.
Deck to promenade do.	13 ft.	of rails to carry	
Saloon, height	8 ft.	luggage - goods'	
Steering-house above do.	7½ ft.	waggons, but not	
Deck of saloon.....	200 ft. by 30 ft.	passenger trains.	
Promenade do.....	300 ft. by 60 ft.		
Could carry on rails.....	300 tons		

There is one feature in this arrangement which, whether the vessel carries sails or not, offers important comfort to ladies and invalids, and preserves intact the comfort of the carriage in which they embark. Thus, the side cabins are in such connection with the doors of the carriages that they can be used for exercise or accommodation during this all-important hour of travel.

The rails occupy the centre line; the carriages are home to the side cabins, and are run in and out by switches leading into the main line.

Both ends are fitted with closing shutters like shop-fronts, and, being closed at pleasure, insure in fine weather thorough ventilation, and in bad keep out wind and sea.

The mode of propulsion to be given is that of the hydraulic or turbine. It possesses the advantage of smooth sides and perfect protection from injury from external force, and is therefore better adapted to take the sides of any irregular dock or piles.

I have special objection to the paddle system; it has not the power of sudden turning in the trough of a sea.

Further, the divided shaft proposed incurs enormous danger, and subjects the machinery to disruption, and vessels and passengers to enormous concussions.

Thus, on an even keel, it is submitted that a vessel of 400 ft. rests on a series of waves. If, then, the trough between two waves denudes the lower float, the wheel will fly round and endanger the machinery.

Again, if the wind be abeam, or the vessel roll in the trough of a heavy swell, even in calm, the rolling of one paddle out of water would cause the engine to race, and with great danger to the destruction of the machinery.

As to the over-immersed paddle, it loses considerable propelling power, at the same time as that of its opposite is utterly lost, thus leaving less than half the propelling force on the ship, and causing consequent loss of speed.

This I have witnessed, and more—the power of steerage, under these circumstances, nearly annihilated.

On this specific point the hydraulic rejoices in her superiority to all other modes of propulsion; seeing that the orifice in the air performs equally or better than that immersed, and the whole force of the engines being exerted to one purpose, and uninfluenced by wind, weather, rolling, or any external causes, acts with uniform force and precision. In fact, like the perfect chronometer, it performs equably and perfectly, secure within its case, just what is demanded.

The paddle steamer in a gale is always unpleasant to handle; the moment speed ceases she wallows in a seaway, and the shocks of the paddle-boxes, alternately striking, are distressing even to those accustomed to sea life.

On the other hand, the hydraulic is but a simple vessel lying to or under small speed, and, but for the thrilling action when at full speed, few could imagine her propelled through the water. She is peculiarly adapted for the difficult work of turning easily in a seaway, when, indeed, it would prove dangerous to the paddle.

Leaving the question of train boats, and coming to the mere passenger boat—with carriages adapted for special objects, and, indeed, appertaining to the vessels—it is proposed to adapt them to rails, and to embark the passengers in them by the aid of machinery.

The difficulty—indeed danger—which has always struck me, has been that of embarking and disembarking, passing down slippery steps frequently in dark nights, and having a lively dancing vessel ready to capsize you the instant you feel you have lost your land and have not gained sea-legs. This difficulty it is proposed to overcome by hydraulic lifts and cranes, lifting the carriages and passengers, with all their comforts about them, over openings in the upper deck, and landing them on platforms fitted to receive them on elastic springs, then moved to positions in direct connection with state rooms, door of carriage to door of state room, as before alluded to. The disembarkation would be similarly carried out, and carriages and passengers taken to the railway station or hotel, accompanied by all simple movables, heavy luggage being confined to proper trucks.

Now, in this mere passenger vessel of the second class in our table, drawing but 7 ft., it is proposed, indeed, to attain the velocity demanded of 20 knots. But I much question, in attaining such speed, if you do not annihilate all idea of comfort or freedom from sickness. All will depend on the state of the weather. It is perfectly futile to expect comfort to those embarked, if the force engaged in the propulsion is sufficient to shake the vessel to pieces, or so damage the machinery as to endanger vessel and passengers.

Leaving, then, the vessels, and looking towards their safety and accommodation on either shore, we arrive at the important question of piers. In November, 1836, I drew up, for the Corporation of Preston, a plan for the embankment of the Ribble, by a dam carried across from the Douglas River to the Naze, a distance of three-quarters of a mile. Mr. Stephenson, the celebrated engineer, engaged on the Clyde navigation, met me by appointment at Preston. That plan, which he most warmly approved, involved the construction by prepared iron caissons, to be simultaneously placed and filled, between the interval of two consecutive tides, with concrete, for which design I hold the thanks of the mayor and corporation, all other engineering authorities being set aside.

I will not contest the point with those who follow my ideas at the present day. But further, in 1858, I again proposed to saddle and fortify the Goodwin Sands by a plan of a similar nature. After an evening meeting at the Institution of Civil Engineers, my friend, the late Charles May and several leading members adjourned to the rooms of Mr. Brunel and discussed my plans. This resulted in the verdict, pronounced by Brunel, short and pithy:—"There can be no doubt of the correctness of your views; get money, and it will be done; compute the contents at 20s. per cubic yard, working expenses the same; Government to supply the funds; it can be effected." So with the moot question of these piers for the accommodation of these steamers. Construct them in iron securely braced, ground and fill them in, previously working in screw piles to receive them exactly, and no sea can displace them.

It is not perhaps generally known that, where iron forms part of the concrete, and remains in contact with salt water for years, the iron becomes converted into a carburet, suffers no further decay, and becomes an incorporated crust-like glaze, similar to the surface of the old Dunes. All iron exposed for years on coral islands becomes attached to the coral block.

Finally, the important point to be considered is time and cost. It has been assumed that the work of forming harbours in masonry would demand at least three years. But I would inquire, looking to the number of days affording the term moderate, how many working days would be required? Then, as to the security from the work being demolished by any violent gale, and further the well-known fact that blocks under ten tons in weight cannot withstand much less wave impact than the exposed parts of our Channel shores; by the process I propose, some thousand tons of matter would be securely placed within twenty-four hours—that is, at the first operation of placing, the weight of iron composing the caissons, and the admitted water would be immovable, like a ship aground, by any sea. Therefore we may safely assume one-third gain in time, allowing a year for construction.

As regards expense, we may safely assume the same proportion—indeed less, if we take into consideration the risk of annual destruction by gales, an effect which never could enter into the calculation of cost by the method I propose.—*Paper read before the Institution of Naval Architects.*

ANIMALS AS FELLOW-BOARDERS.

BY P. J. VAN BENEDEN.

IN THREE PARTS.—PART III.

Fixed Fellow-Boarders.

THE fellow-boarders of which we have been speaking preserve their full and entire independence at all periods of their lives, and as they only undergo ordinary changes in form, their true nature has rarely been misunderstood. By the side of these we see others who are only free during their young days, and when the epoch of puberty approaches they make choice of a host, throw off all their travelling appendages, including their eyes, change their clothes, and become completely dependent upon the animal that carries them. Others, again, only renounce their independence for a time, and preserve even during their sequestration their proper form and their organs of locomotion. The most interesting of the fixed fellow-boarders are evidently the barnacles Tubicinella, Diadema, and Coronula, which cover the skin of whales. They are like all the others, free during their infancy; but for motives of their own, they locate themselves on the head or the back of these great Cetaceans, which they never quit when once settled. That which is of especial im-

portance to these companionships is that each whale lodges particular species, so that the fellow-boarding crustacea are like a flag of nationality, and the equipment causes the ship to be recognized. The great northern whale Mysticetus, which our hardy and patient neighbours discovered on seeking a passage to India by the East, a species which never quits the ice, does not carry barnacles. It is this whale that was already known to Iceland fishermen of the twelfth century. These intrepid whalers distinguised between a northern whale without calcareous adhesions, and a southern whale with them. This last is the celebrated whale of the temperate regions, the "North-Kaper," which the Basques hunted from the tenth century in the Channel, and which at a later period they chased as far as Iceland.

We also find characteristic Cirripeds on the genus Megoptera, on dolphins, on some of the sharks, and on tortoises, and their inferior ranks are met with on sponges, and in the tissues of many true polyps. But if the greater part of these crustaceans lose their proper physiognomy while possessing the appendages symmetrically disposed round the mouth, there are also some who get rid of all their external apparatus, and become a mere sac of sexual organs, such as Sacculina and Peltogaster, who lead a miserable life in the abdomen of common crabs or on the backs of soldier crabs. We also see Cirripeds establishing themselves on other Cirripeds, losing their appendages, and taking the form of the larva of a Diptera. The genera Otion and Cineras, which we find on the keels of ships, as well as on the bodies of fish, are fellow-boarders on other Cirripeds, but preserving their own form.

From the time of the ancients a fish was known, whose position was not well made out till our day, and which seems to belong to the category of fellow-boarders. It is the Echineis, or Remora, an animal found in the Mediterranean and other seas, attached to the bodies of large fish, especially sharks, by means of an apparatus for adhesion situated on its head. It has sometimes been confounded with the pilot fish. It is a fellow-boarder, but, contrary to those just mentioned, can free itself when it pleases, and seek a new host. It lives by its captures during the voyage. The Remora has always attracted the attention of observers. In the eyes of the ancients a singular being, no matter of what sort, must have some peculiar action upon the animal economy, and could not fail to enter into the composition of divers therapeutic preparations. Pliny pretends that the Remora served to compose poisons capable of extinguishing the fires of love.

The sailors now, as of old, are convinced that if one of these little fish adheres to a ship it arrests its course. That which is not doubtful is that the inhabitants of the coast of Mozambique turn to account the Remora's faculty of attaching itself to animals, for they put a ring in its tail, to which they attach a line, and let it go in the sea and stick to what prey it may find. Thus, Remora-fishing is the counterpart of hawking.

Amongst the Polyzoa there is a curious genus living on Annelids, and concerning the nature of which we have been led into error. My fellow-labourer, M. Hesse, represented it as a Trematode with a stalked sucker situated behind, and we have given it the name of Cyclatella, which ought to be abandoned. The pretended Trematode is a true Polyzoon belonging to the genus Loxosma, and which lives as a fellow-boarder fixed on the Annelids.

There are likewise fellow-boarders, who in their early growth place themselves under the protection of a complaisant neighbour or a parent, and are then transported to their destination. These do not lose the character of their youth. Among them are the young of the Caligus; for, according to the observations of M. Hesse, of Brest, these Crustaceans, in order to reach the fish they are destined for, attach themselves to a parent or a friend by the aid of an appendix of the cephalo-thorax, and are rowed to their residence.

Forty years ago, Jacobson of Copenhagen wrote a memoir to demonstrate that the young bivalves which are found on the external branchiæ of Anodonts are parasites, for which he proposed the name Glochidium, and Blainville and Duméril were requested to report on this paper, which was sent to the French Academy. Their opinion gained few supporters, and it is now well known that the young Anodonts differ considerably from the adults, and that during their sojourn in the branchiæ they carry a long cable which descends from the middle of the foot. What is this cable for? Is it to attach the young Anodont to the body of some fish which will carry it to a distance? The Anodonts have not, like other Acephala, or headless mollusks, vibratile wheels to disperse themselves.

At the bottom of ponds and rivers there are Rotifers and Infusoria which attach themselves to Crustaceans and insects, and travel like the Cirripeds of the whales. There thus exist fellow-boarders of the two categories in the lower ranks of aquatic animals.

We shall finish by remarking that in all combinations between individuals of different sexes, as between those of different species, we always find the object attained, the conservation of the individual and the conservation of the species. These phenomena evidently depend on the secret ordinance of Providence, and the life of the humblest worm hangs from the same thread as that of the greatest mammal. A breath suffices for their creation and their annihilation. God holds the chains of all their existences, and conducts them to their end. It is for us to observe the facts, and to guess in generalizing them the laws by which they are regulated. And if we have need of an hypothesis to guide us through the dark places, do not let us assign to it the importance of a scientific conquest, for this hypothesis is only a beacon to guide us on our route.

We close here for the moment the observations to which we may revert some day. In conclusion, let us repeat the words we lately used under analogous circumstances and in this place —the grandeur of nations is measured to-day by the scale of their intelligence. Let us take our part in those learned researches which are assigned to us amongst European peoples, and encourage with all our power the study of the sciences and the cultivation of the arts, those two levers of civilization. In that let us place our glory. Instead of stifling the spirit of investigation in our superior schools, and leading minds to expend their forces in sterile disputations, constitutional governments should, more than absolute monarchies, afford a good example, and without ceasing urge the nation to the glorious and fruitful conquests of science.—*The Student.*

The Arithmometer.—This instrument has been very much improved of late years. To give some idea of the saving of time effected by this instrument, eight figures (tens of millions) can be multiplied by eight figures in eighteen seconds; sixteen figures be divided by eight figures in twenty seconds; and a square root of sixteen figures be extracted, with the proof, in less than two minutes. It is constructed chiefly of a brass plate, furnished with eight slots; directly under these slots are mounted eight drums, each having nine elongated cog-teeth of successively decreasing length; over each drum, and between it and the slot, is mounted a square shaft, on which slides a pinion-wheel, so as to catch any number of teeth on the drum. Each of these pinion-wheels is moved by a button, of which there is one in each slot, the figures at the sides of the slots showing the proper position of each button, for any work to be performed by the instrument. The cogged drums gear by bevil-wheels with a long horizontal shaft, which is also in gear with the vertical shaft, moved by a handle, by which the instrument is worked. In a movable brass plate, which can turn and slide on a round bar-hinge at the back, there are sixteen holes, under each of which is a moveable disk, numbered from 0 to 9, and arranged so that any one figure of each disk may be brought under its corresponding hole. These disks have bevil-wheels, which gear with bevil-wheels on the before-mentioned square shafts. The moveable plate is also furnished with holes, having disks, numbered from 0 to 9, underneath, and are for showing the number of turns of the handle, giving by this means the quotient in division, and showing the multiplier. Such is the general construction and principle of the machine, which can be seen at the South Kensington Museum, or at the office of Mr. W. A. Gilbee, 4, South-street, Finsbury.

REVIEWS OF BOOKS.

Madagascar and its People. Notes of a Four Years' Residence, &c. By James Sibree, Jun. London: The Religious Tract Society. 1870.

WITHOUT pretending to be a scientific work of travel, Mr. Sibree's book is one from which the naturalist may learn a good deal that is interesting and useful. Published by the Religious Tract Society, it is designed especially to show the nature of the people with whom the missionaries have to cope; but, as the portion of the work devoted to this subject is limited and apart, the author's narrative may be read by those who take no interest in the establishment of one particular "mission" over others. Indeed, we would in passing express our belief that, with the exception of those who are exactly of Mr. Sibree's way of thinking on religious matters, his comments on the efforts and labours of the Roman Catholic missionaries will be read with a feeling of pain, and with some scepticism as to the author's strict impartiality. But laying aside this part of the book, we find a series of chapters full to overflowing with well-detailed sketches of the country and its animal and vegetable inhabitants. In some few instances the author appears to possess a limited knowledge of general natural history; this, however, being partly compensated for by the careful observations which he has evidently made, and by the truthful manner in which he records them. It is a noticeable feature of this work, too, that Mr. Sibree, in endeavouring to make it a book of reference on its subject, has compiled from various sources, especially French, some good descriptions of the more striking geological types of this singular island, which, though so near the African shore, resembles the great continent so little in the character of its fauna and flora.

BÉTSIMISÀRAKA WOMAN AND CHILD.

As the zoologist might anticipate, one of the first creatures which the author deals with as belonging to the indigenous mammals of Madagascar, is the Aye-Aye. And here it is much to be regretted that his account of this singular animal is given second-hand—that too from Professor Owen's account in his well-known monograph. We are told of the wonderful "evidence of design" which the *Cheiromys* displays, of its large eyes and acute power of hearing, of its chisel-shaped teeth, and of that marvellous hook-like claw, and much more, which recalls Professor Owen's graphic pen. But is it not a pity that, in preparing this description, the author did not consult some of those naturalists who carefully studied the habits of the Aye-Aye which was sent over some years since to the Zoological Society? We fear that had he done so, and had he learnt some of the experiments tried with the little animal, his teleological enthusiasm would have been considerably diminished.

In connection with the distribution of mammalia in Madagascar, Mr. Sibree draws most of his materials from Dr. P. L. Sclater's writings. Nevertheless, his remarks will interest deeply those students of physical geography who are not already familiar with the remarkable conclusions arrived at by the Secretary of the Zoological Society. Speaking of the decided absence of mammalian types, he says:—

"First of all, the large Carnivora are all wanting. There are no lions, leopards, tigers, panthers, or hyænas; nothing larger than a wild cat and a small species of wolf being known. The large thick-skinned animals so plentiful in every river and forest in Africa have no representatives in Madagascar. No elephant browses in the woods, no rhinoceros or hippopotamus lazily gambols in the streams. The numerous species of antelope, gazelle, deer and giraffe which scour the African plains are entirely absent, and, excepting two varieties of ox, there is no specimen of this useful class of mammals. Even the horse has been introduced from Europe, while its cousins, the zebra and quagga, have no place in the Madagascar fauna. The order of Mammalia most developed is the four-handed or quadrumana; but this again is represented by but a single group—the lemurs—which are the most characteristic animals of the island. There are no true monkeys or apes, nor does the gorilla put in an appearance. . . . . As far as yet known, the mammalia of Madagascar consist of only forty-nine species—an extraordinarily small number for such a large island; and of these twenty-eight belong to the Lemuridæ. Still stranger is the fact that these animals are allied to Asiatic rather than

to African forms. These are certainly most remarkable and anomalous occurrences; and from them and other zoological facts, Dr. Sclater has drawn the following conclusions:—1, That Madagascar has never been connected with Africa, as it at present exists. (2) That Madagascar and the Mascarene islands must have remained for a long period separated from every other part of the globe; and 3, that some land-connection must have existed in former ages between Madagascar and India.'

In some of the subsequent chapters the domestic and other customs of the people are forcibly described, the ceremony of marriage being among the most interesting. And here we may pause to point out a curious feature in regard to the question of descent, which indicates that the "good men" of Madagascar have no profound faith in the fidelity of their spouses. "The restrictions upon the marriage of relatives," says Mr. Sibree, "are chiefly with respect to those connected on the female side. It is a significant fact, and shows the lax state of morals, that the descent of sovereigns and nobles is reckoned through the female rather than the male line; as it is argued that the descent can be proved from the mother, while it is often impossible to know the paternity of a child." Marriages, as in India, appear to be celebrated at an early age, thirteen and fourteen years being often the respective ages of the bride and bridegroom.

Passing over the several chapters which deal with the traditions, songs, and industry of the people, we find in the 10th chapter a good account of the philological and anthropological problems connected with the origin of the Malagasy. The author very justly regards the race as one derived from some Asiatic country, or from some source originally directly united to Asia. Provisionally he is disposed to consider the people as closely related to the Malays. This view he thinks borne out by the language particularly, for "not only are some words absolutely identical with those spoken in the Malay peninsula; but, what is far more important, the *structure* of the language, and especially the manner of forming the verbal inflections, is exactly the same." After giving an outline of the arguments in favour of the theory of Malayan origin, he then passes on to describe the various tribes or groups of people (five in number) which inhabit the country. Of these the Bétsimisàraka constitute one million, or about a fourth of the whole; and a very good illustration of their physical character is afforded in the figures on p. 427, the blocks of which have been courteously lent us by the publishers.

The final chapters in the volume relate to the history of the island during its period of civilization, and deal with the persecution of the missionaries and other matters connected therewith. It is not uninteresting, but cannot be called scientific. The appendix contains some valuable material for the naturalist, and the illustrations scattered through the pages are numerous and well executed; and thus the whole work is one which must take a very high rank in our geographical literature.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

The Portland Cavern.—*From* W. Pengelly, F.R.S.

Sir,—In Scientific Opinion, Sept. 29, 1869, you were so good as to inform "local geologists" generally, and me in particular, that a cavern, probably deserving attention, had just been discovered in the "isle" of Portland. Though on a clear day Portland can be seen from the heights in this district, it is so far distant by railroad as to absorb fully seven hours in getting there. This fact must be my excuse for not having visited the cavern until about a week ago.

Instead of troubling you with particulars respecting its dimensions, which were given by your correspondent, "E. W. H.," in Scientific Opinion, December 15, my present intention is merely to state that the Portland rocks are traversed by four well-marked systems of "joints," the directions of which, according to the quarrymen, are—1st, from N.W. to S.E.; 2nd, from N. to S.; 3rd, from E. to W.; and 4th, from N.E. to S.W. The first and second are the most prevalent, and are known as "Rangers" and "Southers" respectively.

When examining the cavern with Mr. Vicary, F.G.S., we noted that the directions of its various branches coincided closely with those of the different joints, and that the line of jointage itself ran longitudinally along the roof. In short, the conclusion to which we were led was, that the cavern had been formed by the corrosion and erosion of the rocks in directions predetermined by the joints of the formation—a conclusion to which I have come also respecting at least every *limestone* cavern with which I am acquainted.

The other joints necessarily cross each branch or gallery. It is at these intersections that the lateral openings occur which were mentioned by "E. W. H." Our guide complained that before he took means to prevent them, boys sometimes got in from the adjacent quarries, and did a great deal of "mishty"—a Portland synonym for both "mischief" and "mischievous."

The floor in some parts consisted of very fine earth, and in others

of blocks of stone which from time to time had fallen from the roof and sides, and were occasionally cemented together with stalagmitic matter. The quarrymen, in order to make a better road, had torn up many of these blocks and thrown them aside, but neither between them nor in the fine earth had any organic remains been found.

Our guide informed us that the quarry was known as *Slit Craft* (not *Kitcraft*) quarry, in *Wide Street*, the word *street* being invariably used for *road* in Portland.

I am, &c.,

Torquay, May 7. WM. PENGELLY.

THE DEVELOPMENTAL RELATION OF VORTICELLA AND ACTINOPHRYS.—*From* MR. STANILAND WAKE, F.A.S.L.

SIR,—I am able to confirm in a curious manner the assertion of Stein, that certain forms of *Actinophrys* are really phases of the development of *Vorticella Microstoma*. Some time ago I had sent to me samples of paper which had been used for straining wine, bottled, *in vacuo*, according to a system lately introduced. The paper thus used was, I presume, of the same kind in each case; but of the four pieces which reached me, one was but slightly discoloured, another was then of a brownish hue, a third was pinkish, and the fourth of a darker colour, approaching marone. My object in obtaining these papers was to try the effect of infusion, and although there must necessarily be some degree of uncertainty as to whether the results produced are traceable wholly to the colouring matter, they are so curious that they deserve to be recorded.

Separate infusions with distilled water were made of these four papers, but the general results were so much the same in each case that there is no occasion to describe them independently. The first change observable in the fluid, with the unassisted eye, was the appearance at the bottom of the bottles of that fluffy-looking substance which is developed from seeds or pollen when placed under similar conditions. On examination of this substance with the microscope, it was found to consist of a minute fungoid growth, sometimes, but not always, in association with thick fibres, which may have been derived from the paper. Attached to the fungoid substance were numerous round bodies, probably infusorial germs, and also many free-moving infusoria, which, however, judging from their spasmodic movements, were still united to the fibrous mass, although the thread which bound them was invisible. There was nothing peculiar about these infusoria, all of which I recognized as having met with on many other occasions. The infusions produced, moreover, bodies of a circular form, which I have now little doubt were encysted forms of Vorticella. In addition to these, however, were a number of larger bodies of different shapes, the nature of which I could not for some time determine. That they were animal organisms I did not doubt. Their appearance—that of a nearly circular and nucleated cell, with an outer faintly-defined rim—was sufficient to induce this belief. No motion was at first noticeable, but I soon found that the shape of these bodies altered, and I at once set them down as having an amœbal character. This idea appeared to be confirmed by the fact that free-moving amœbæ were also present in these infusions.

I have not studied the changes of Vorticella, and therefore I was much surprised, on examining these infusions some days later, to find a great number of these forms in full activity. What is the explanation of this fact? It was soon made apparent by a reference to Pritchard's fine work on Infusoria. At plate 27, Pritchard gives several figures of *Vorticella microstoma*, this being, I have no doubt, the form which was so plentiful in my infusions. On plate 23, moreover, several forms are figured, which I at once recognized as those which I had supposed to be amœbal. In Pritchard, these are classed with *Actinophrys*, but they are described as having been figured by Stein as phases in the development of *Vorticella microstoma*. Eight of these phases are given by Stein, and of these Nos. 1 and 2 in Pritchard almost perfectly represent the forms produced in my infusions. In addition, however, to *Vorticella microstoma* were several other analogous forms, among them one much resembling *Actinophrys linguifera* or *Acineta* (Pritchard, pl. 23, fig. 17). Since I noted the above facts, most of the Vorticella have disappeared, and the circular bodies have increased very largely in number, the smaller ones being extremely numerous. These bodies are nearly always associated with the fungoid matter. They evidently increase in size, and seem to me to be phases of the encysting process of *Vorticella microstoma*, as figured by Dr. Carpenter in his work on the microscope. In addition to the infusoria referred to, the infusions now contain several other forms, among them *Kolpoda cucullus*.

Along with the development of infusorial life there has been a rapid increase in the fungoid matter formed in the several infusions, the colour of which agrees well with that of the paper used in the experiments. The darkest paper has tinted the water the most highly, and this infusion presents the most abundant fungoid development. The colour of the fungus closely agrees, too, with that of the fluid, especially in the case of the two darkest infusions. The general form taken by the fungoid matter present in these is that of very irregularly shaped masses of a pinkish colour, approaching red, and exhibiting but slight trace of fibrous formation. Mixed up with this, however, is often seen, especially in the darkest infusion, a curious fungus growth, the pinkish stems of which are curved and irregularly branched, presenting a beautiful object under the microscope. I have not been able to determine the relation between the two forms thus associated, neither of which have I met with in any other infusion.

I am, Sir, yours obediently, C. STANILAND WAKE.

METEOROLOGY OF APRIL.—*From* MR. JOHN JAMES HALL.

SIR,—I beg to send you a few particulars of the weather of the past month, deduced from daily observations with standard instruments.

The barometer is a standard on Fortin's principle, and its readings have been corrected for capillarity and index error, determined by comparison at the Royal Observatory, Greenwich, and reduced to 32° Fahr. and mean sea level.

The thermometrical readings have been corrected for index error, determined by comparison at the Kew Observatory of the British Association.

The dew point, relative humidity, tension or elastic force of vapour, vapour in a cubic foot of air, and weight of a cubic foot of air, are calculated from Glaisher's hygrometrical tables and observations of Mason's (verified) hygrometer.

The readings of the "self-registering" thermometers, the rainfall, and ozone, are inserted on the actual days. The rainfall, *e. g.*, measured at 7h. 45m. a.m., is placed to the previous day, which contains 16h. 15m. out of twenty-four hours.

The "maximum" and "minimum" (shade) thermometers are suspended on a stand similar to that described in Drew's *Practical Meteorology*, Part II., p. 82, 60, and plate iv. fig. 1. The stand is permanently fixed, and the instruments, which face the north, are protected from the rays of the sun, when his azimuth is north of east or west, by louvre boarding fixed clear of the stand on the north, east and west sides. The stand is fitted with three open roofs, allowing the air to circulate freely.

The instruments from which the readings marked * are taken are situated about 36 chains to the E.N.E. of the other instruments. This is essential to insure free exposure, and therefore greater accuracy.

The receiving surface of the rain-gauge (Glaisher's improved) is 8 in. in diameter and is 12 ft. above the ground.

The observations of the 26th and 27th were unavoidably omitted, but in some particulars no difference arises from this source. (*Vide* "General Results," to which these remarks *only* refer.

I am, Sir, your obedient Servant,

JOHN JAMES HALL.

Mount Ararat and St. Mary's Grove, Richmond, S.W., May 2.

GENERAL RESULTS.

The following means, &c., for the twenty-five days (except where otherwise noted) ending 25th, have been deduced from the accompanying table. (A close approximation to the true monthly means may however be obtained by taking the following quantities twice, *i. e.*, for both days on which the observations were omitted, and afterwards deducing the results.):—

Mean height of the barometer (corrected)	30·214 in.
Highest observed reading (April 4)	30·540 in.
Lowest observed reading (April 9)	29·529 in.
Observed range (25 days)	1·011 in.
Mean height of the barometer expressed in millimétres	767·4
Mean pressure of air due to gases separated from water in air	29·956 in.
Mean temperature of the air (8 a.m.)	46·21°
" " " " (centigrade scale)	7·89°
" " of evaporation	43·11°
" " of dew point	39·75°
Mear relative humidity (saturation = 100)	79°
Mean pressure of vapour of water, expressed in inches of mercury	250 in.
Mean weight of water in a cubic foot of air	2·8grs.
Mean weight of a cubic foot of air	553·3grs.
Highest reading of maximum thermometer (April 20)	80·2°
Lowest reading of minimum thermometer (April 4)	24·7°
Range for 22 days (3rd to 24th)	55·5°
Mean daily range (to inclusive	
Mean force of wind 8 a.m. (estimated scale 0 to 6)	1·0°
Total rainfall	0·400 in.
Mean amount of ozone (0 to 10)‡	1
Maximum of ozone (April 10th, a.m.)‡	6

Marked thus ‡ are approximate.

The weather was characterized by unusual atmospheric phenomena for the season. The maximum temperature exceeds that of the same

month last year at the Kew Observatory, which is 1m. 9f. 5e. distant, by 4°; the minimum temperature was 3·7° lower; the rainfall is less by 0·965 in. Among the chief modifications of the clouds may be mentioned cumulus and cirrocumulus, but at times the sky presented a threatening appearance although comparatively little rain fell. The air was at times highly charged with moisture. The wind appears to have veered or *retrograded* through all the points of the compass, the prevailing directions being on the western side.

TABLE OF METEOROLOGICAL ELEMENTS OBSERVED DURING THE MONTH OF APRIL, 1870, BY JOHN J. HALL, RICHMOND, SURREY.

Latitude, 51° 27′ 36″ N.; *longitude*, 0° 15′ 0″ W.; *height above sea*, 64 feet. *Time of observation* 7.55†, 8 a.m.

Date.	Barometer (corrected).	Pressure of Dry Air.	Dry Bulb.	Wet Bulb.	Dew Point.	Humidity. (adm.=100.)	Tension of Vapour.	Vapour in cubic foot air.	Weight of cubic foot of air.	Maximum *	Minimum *	Direction.	Established force. (0 to 6.)	Rainfall. *	Ozone. (0 to 10.)
	Inches.	Inches.	°	°	°		In.	Grs.	Grs.	°	°			In.	
1	30·279	30·054	34·1	33·8	33·4	97	·191	2·3	567·6			E.S.E.	·5	—	4
2	30·291	30·093	33·9	32·6	30·3	86	·170	2·0	568·4			W.N.W.	·5	—	0
3	30·420	30·209	37·1	35·7	33·7	87	·193	2·2	567·3	54·5		E.N.E.	·5	—	0
4	30·540	30·321	35·6	35·0	34·1	94	·198	2·3	571·0	54·7	24·7			—	0
5	30·394	30·175	35·7	35·4	34·2	94	·198	2·3	567·8	60·8	32·2	E.	·5	—	1
6	30·180	29·985	35·8	34·0	31·3	84	·177	2·0	564·3	65·1	26·7	E.S.E.	1·0	—	a.m. 0 p.m. 0
7	30·059	29·859	41·6	37·8	33·1	72	·190	2·1	555·7	67·0	30·5	W.S.W.	·5	—	0 1
8	29·756	29·494	49·4	45·3	40·9	72	·257	3·0	541·2	65·1	35·9	S.	1·0	—	0 1
9	29·529	29·233	48·4	46·1	43·6	85	·284	3·2	538·2	55·3	42·5	S.S.W.	1·0	·143	3 5
10	29·767	29·534	43·7	40·5	36·8	77	·269	2·5	547·7	54·4	38·8	W.	2·0	·100	6 0
11	30·134	29·862	45·1	43·2	41·0	85	·321	2·9	552·6	59·8	37·4	W.S.W.	1·0	—	2 0
12	30·206	29·969	44·8	41·4	37·5	75	·224	2·6	554·5	60·2	33·9	W.	·5	—	1 1
13	30·224	29·945	48·3	45·4	42·2	80	·269	3·1	551·7	65·1	40·0	W.	1·5	—	5 0
14	30·255	29·935	53·7	50·3	47·0	77	·321	3·6	545·2	64·6	46·7	W.	1·0	—	2 0
15	30·382	30·118	51·2	46·3	41·3	68	·260	3·0	550·7	64·8	42·4	N.W.	1·5	—	1 0
16	30·510	30·246	45·7	43·4	40·8	83	·255	2·9	558·9	70·8	37·5	W.	·5	—	0 0
17	30·437	30·195	48·4	44·0	39·2	71	·240	2·8	555·8	68·7	37·7	Z.	·0	—	0 3
18	30·274	30·004	45·9	44·0	41·9	86	·266	2·2	554·5	61·0	40·7	E.S.E.	1·0	—	6 1
19	30·054	29·775	48·3	45·6	42·6	82	·274	3·1	548·8	74·6	38·4	E.	·5	—	0 2
20	30·027	29·713	62·2	54·5	47·9	59	·334	3·7	532·8	80·2	42·8	S.	·5	—	0 1
21	30·148	29·817	56·9	52·3	48·1	72	·346	3·8	540·2	75·5	48·2	N.N.E.	·5	—	0 1
22	30·318	30·030	51·1	49·4	44·8	71	·295	3·4	546·3	69·5	39·8	S.W.	1·0	—	2 4
23	30·351	30·118	50·8	44·9	38·7	63	·237	2·6	550·9	64·8	45·5	N.W.	1·0	—	4 0
24	30·416	30·139	49·4	46·3	43·0	79	·278	3·2	553·3	62·5	41·1	W.S.W.	1·5	—	3 1
25	30·395	30·085	55·1	50·6	46·3	73	·314	3·5	546·6		47·7	W.	1·0	—	3 0
26															
27										66·8					
28	30·117	29·895	40·7	38·0	34·6	79	·200	2·3	557·3	50·1	36·4	N.N.E.	·5		0 0
29	30·031	29·840	44·2	38·3	31·5	59	·175	2·1	552·1	52·9	35·9	W.N.W.	1·5		0 0
30	29·768	29·444	48·8	47·6	46·3	92	·316	3·5	541·7	58·0	41·2	N.W.	1·5		0 0

* Barometer station. † Approximate height of Terhmometer station above sea, 35 ft.

Ozone, 1st to 6th, inclusive = 8 to 24 hours; remainder of month, average 12 hours.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

THURSDAY, MAY 5TH.—The Bakerian Lecture.—"On the Pre-Carboniferous Floras of North-Eastern America, with especial reference to that of the Erian (Devonian) Period," by J. W. Dawson, LL.D., F.R.S., &c., Principal and Vice-Chancellor of M'Gill University, Montreal.—The attention of the author was first directed to the Devonian, as distinguished from the Carboniferous flora, by the discovery, on the part of Sir W. E. Logan, in 1843, of some remarkable remains of plants in the sandstones of Gaspé, Canada. In 1859, after visiting Gaspé to study these plants *in situ*, descriptions of them, and more particularly of the two characteristic Lower Devonian genera *Prototaxites* and *Psilophyton*, were published in the Journal of the Geological Society.

Subsequently additional material was obtained by personal investigation of the Devonian of Maine and New Brunswick, and through the kindness of Professor James Hall, from that of New York. These additional plants were also published in the Journal of the Geological Society.

Still more recently, a thorough re-examination of the Gaspé beds, the systematic exploration of the plant-bearing beds near St. John by Professor Hastt, and fresh collections made by Professor Hall, have enabled the author to prepare a catalogue of 121 species, and to attempt a thorough revision of the Erian flora, and an investigation of its conditions of growth and relations to the Carboniferous flora.

The term "Erian" is applied to the formations included between the top of the Upper Silurian and the base of the Carboniferous, on account of the uncertainties which have attended the subdivision and limitation of the Devonian of Europe, and also on account of the immense area occupied by these beds on the south and west of Lake Erie, and their admirable development with regard to subdivisions and fossils. The name "Erie Division" was also that originally applied to this typical series by the geologists of the Survey of New York.

A large part of the paper was occupied with the revision of the Erian flora, including the description of twenty-three new species, and more ample descriptions of others previously known only in fragments. Large trunks of *Prototaxites*, from the base of the Lower Devonian, were described, and full details given of the form, structures, and fructification of two species of *Psilophyton*. The new genus *Ormoxylon* was described. The genus *Cyclostigma* was noticed, as represented by two species in America, and its foliage and fruit described for the first time. The genera of the Erian ferns were examined and corrected, and several interesting trunks and stipes belonging to tree-ferns were described. The fruits of the genus *Cardiocarpum* were illustrated with reference to their structure. The occurrence of *Lepidophloios*, *Calamodendron*, and other forms in the Middle Devonian was noticed for the first time.

The third part of the memoir was occupied with comparisons and general conclusions. At the close of the Upper Silurian period there was a great subsidence of the land in Eastern America, proved by the wide extent of the marine beds of the Lower Helderberg (Ludlow) group. It was on the small areas of Lower Silurian and Laurentian land remaining after this subsidence that the oldest land plants known in the region flourished. Re-elevation occurred early in the Devonian period, and the known flora receives considerable extension in the shallow-water beds of the Lower Erian, The subsidence indicated by the great Carboniferous limestone interrupted these conditions on the west side of the Appalachians, but not on their eastern side. At the close of this we find the rich Middle Devonian flora, which diminishes toward the close of the period; and after the physical disturbances

which on the east side of the Appalachians terminated the Erian age, it is followed by the meagre and quite dissimilar flora of the Lower Carboniferous; and this, after the subsidence indicated by the Carboniferous limestone, is followed by the coal-formation flora.

If we compare the Erian and Carboniferous floras, we find that the leading genera of the latter are represented in the former, but for the most part under distinct specific forms; that the Erian possesses some genera of its own, and that many Carboniferous genera have not yet been recognised in the Erian. There is also great local diversity in the Erian flora, conveying the impression that the conditions affecting the growth of plants were more varied, and the facilities for migration of species less extensive than in the Carboniferous.

In comparing the Erian flora of America with the Devonian of Europe, we meet with the difficulty that little is known of the plants of the Lower and Middle Devonian in Europe. There are, however, specimens in the Museum of the Geological Survey which show, in connection with facts which can be gleaned from the works of continental writers, that *Psilophyton* occupied the same important place in Europe which it did in America; and in the Upper Devonian the generic forms are very similar, though the species are for the most part different.

In Eastern America no land flora is known below the Upper Silurian; and even in that series the plants found are confined to the genus *Psilophyton*. Independently, however, of the somewhat doubtful Lower Silurian plants stated to have been found in Europe, there are indications, in the Lower Erian flora, that it must have been the successor of a Silurian flora as yet almost unknown to us; and the line of separation between this old flora and that of the Devonian proper, seems to be at the base of the Middle Devonian.

In applying these facts and considerations to the questions relating to the introduction and extinction of species, and the actual relations of successive floras, it was proposed to compare what might be called specific types—that is, forms which in any given period could not be rationally supposed to be genetically related. Of these specific types, at least fifty may be reckoned in the Erian flora; of these, only three or four are represented in the Carboniferous by identical species, while about one-half are represented by allied species. The remainder have no representatives.

A table of specific types of the Erian was given, and its bearing shown on the questions above referred to; and the hope was expressed that, by separating such types from doubtful species and varietal forms, some progress might be made towards understanding, at least, the times and conditions in which specific types were introduced and perished, and the range of varietal forms through which they passed.

The following paper was crushed out in our last number.

"On Supra-annual Cycles of Temperature in the Earth's Surface-crust," by Prof. C. Piazzi Smyth, F.R.S.—The author in this paper presents and discusses here the completely reduced observations, from 1837 to 1869 inclusive, of the four great earth-thermometers sunk into the rock of the Calton Hill, at the Royal Observatory, Edinburgh, by the late Principal Forbes, pursuant to a vote by the British Association for the Advancement of Science.

Leaving on one side the several natural-philosophy data which have been investigated from smaller portions of the same series of observations both by Principal Forbes and Sir William Thomson, the author applies himself solely to trace the existence of other cycles than the ordinary annual one in the rise and fall of the different thermometers.

Of such cycles, and of more than one year's duration, he considers that he has discovered three; and of these the most marked has a period of 11·1 years, or practically the same as Schwabe's numbers for new groups of solar spots. Several numerical circumstances, however, which the author details, show that the sun-spots cannot be the actual cause of the observed waves of terrestrial temperature, and he suggests what may be; concluding with two examples of the practical use to which a knowledge of the temperature cycles as observed, may at once be turned, no matter to what cosmical origin their existence may be owing.

"On a Cause of Error in Electroscopic Experiments," by Sir Charles Wheatstone, F.R.S.—To arrive at accurate conclusions from the indications of an electroscope or electrometer, it is necessary to be aware of all the sources of error which may occasion these indications to be misinterpreted.

In the course of some experiments on electrical conduction and induction which I have recently resumed, I was frequently delayed by what at first appeared to be very puzzling results. Occasionally I found that I could not discharge the electrometer with my finger, or only to a certain degree, and that it was necessary, before commencing another experiment, to place myself in communication with a gas-pipe which entered the room. How I became charged I could not at that time explain; the following chain of observations and experiments, however, soon led me to the true solution.

I was sitting at a table not far from the fireplace, with the electrometer (one of Peltier's construction) before me, and was engaged in experimenting with disks of various substances. To insure that the one I had in hand, which was of tortoiseshell, should be perfectly dry, I rose and held it for a minute before the fire; returning and placing it on the plate of the electrometer, I was surprised to find that it had apparently acquired a strong charge, deflecting the index of the electrometer beyond 90°. I found that the same thing took place with every disk I thus presented to the fire, whether of metal or any other substance. My first impression was that the disk had been rendered electrical by heat, though it would have been extraordinary that, if so, such a result had not been observed before; but on placing it in contact with a vessel of boiling water, or heating it by a gas-lamp, no such effect was produced. I next conjectured that the phenomenon might arise from a difference in the electrical state of the air in the room and that at the top of the chimney; and to put this to the proof, I adjourned to the adjacent room where there was no fire, and bringing my disk to the fireplace I obtained precisely the same result. That this conjecture, however, was not tenable was soon evident, because I was able to produce the same deviation of the needle of the electrometer by bringing my disk near any part of the wall of the room. This seemed to indicate that different parts of the room were in different electrical states; but this again was disproved by finding that when the positions of the electrometer and the place where the disk was supposed to be charged were interchanged, the charge of the electrometer was still always negative. The last resource was to assume that my body had become charged by walking across the carpeted room, though the effect was produced even by the most careful treading. This ultimately proved to be the case; for, resuming my seat at the table and scraping my foot on the rug, I was able at will to move the index to its greatest extent.

Before I proceed further I may state that a gold-leaf electrometer shows the phenomena as readily.

When I first observed these effects the weather was frosty; but they present themselves, as I have subsequently found, almost equally well in all states of the weather, provided the room be perfectly dry.

I will now proceed to state the conditions which are necessary for the complete success of the experiments, and the absence of which has prevented them from being hitherto observed in the striking manner in which they have appeared to me.

The most essential condition appears to be that the boot or shoe of the experimenter must have a thin sole and be perfectly dry; a surface polished by wear seems to augment the effect. By rubbing the sole of the boot against the carpet or rug, the electricities are separated, the carpet assumes the positive state and the sole the negative state; the former being a tolerable insulator, prevents the positive electricity from running away to the earth, while the sole of the foot, being a much better conductor, readily allows the charge of negative electricity to pass into the body.

So effective is the excitation, that if three persons hold each other by the hands, and the first rubs the carpet with his foot while the third touches the plate of the electrometer with his finger, a strong charge is communicated to the instrument.

Even approaching the electrometer by the hand or body, it becomes charged by induction at some distance.

A stronger effect is produced on the index of the instrument if, after rubbing the foot against the carpet, it be immediately raised from it. When the two are in contact, the electricities are in some degree coerced or dissimulated; but when they are separated, the whole of the negative electricity becomes free and expands itself in the body. A single stamp on the carpet, followed by an immediate removal of the foot causes the index of the electrometer to advance several degrees, and by a reiteration of such stamps the index advances 30° or 40°.

The opposite electrical states of the carpet and the sole of the boot were thus shown: after rubbing, I removed the boot from the carpet, and placed on the latter a proof-plate (*i. e.* a small disk of metal with an insulating handle), and then transferred it to the plate of the electrometer; strong positive electricity was manifested. Performing the same operation with the sole of the boot a very small charge was carried, by reason of its ready escape into the body.

The negative charge assumed by sole-leather when rubbed with animal hair was thus rendered evident. I placed on the plate of the electrometer a disk of sole-leather and brushed it lightly with a thick camel's-hair pencil; a negative charge was communicated to the electrometer, which charge was principally one of conduction, on account of the very imperfect insulating power of the leather.

Various materials, as india-rubber, gutta percha, &c., were substituted for the sole of the boot; metal plates were also tried; all communicated negative electricity to the body. Woollen stockings are a great impediment to the transmission of electricity from the boot; when these experiments were made I wore cotton ones.

When I substituted for the electrometer a long wire-galvanometer, such as is usually employed in physiological experiments, the needle was made to advance several degrees.

At the meeting of the British Association at Dublin in 1857, Professor Loomis, of New York, attracted great attention by his account

of some remarkable electrical phenomena observed in certain houses in that city. It appears that in unusually cold and dry winters, in rooms provided with thick carpets and heated by stoves or hot-air apparatus to 70°, electrical phenomena of great intensity are sometimes produced. A lady walking along a carpeted floor drew a spark one quarter of an inch in length between two metal balls, one attached to a gas-pipe, the other touched by her hand; she also fired ether, ignited a gas-light, charged a Leyden jar, and repelled and attracted pith-balls similarly or dissimilarly electrified. Some of these statements were received with great incredulity at the time, both here and abroad, but they have since been abundantly confirmed by the professor himself and by others.—(See Silliman's *American Journal of Science*, July 1858.)

My experiments show that these phenomena are exceptional only in degree. The striking effects observed by Professor Loomis were feeble, unless the thermometer was below the freezing-point, and most energetic when near zero, the thermometer in the room standing at 70°. Those observed by myself succeed in almost any weather, when all the necessary conditions are fulfilled. Some of these conditions must frequently be present, and experimentalists cannot be too much on their guard against the occurrence of these abnormal effects. I think I have done a service to them, especially to those engaged in the delicate investigations of animal electricity, by drawing their attention to the subject.

GEOLOGICAL SOCIETY.

APRIL 27TH.—R. A. C. Godwin-Austen, Esq., F.R.S., vice-president, in the chair. Robert Logan Jack, Esq., of the Geological Survey of Scotland; George Alexander Lebour, Esq., of the Geological Survey of England and Wales; Coles Child, Esq., of the Palace, Bromley, S.E., and Harry Rivington, Esq., 22, Finsbury-square, N., were elected fellows of the society; and Professor Joseph Szabo, of Pesth, was elected a foreign correspondent.

The following communications were read:—"On the Species of Rhinoceros, whose remains were discovered in a Fissure-cavern at Oreston in 1816," by George Busk, Esq., F.R.S., F.G.S.—The object of this paper was to show that the rhinoceros whose remains were discovered by Mr. Whidbey in a fissure-cavern at Oreston, near Plymouth, in the year 1816, and described by Sir Everard Home in the *Philosophical Transactions* for 1817, belonged, not as has hitherto been supposed by every one except the late Dr. Falconer, to *Rhinoceros tichorhinus*, but to *Rh. leptorhinus*, Cuv. (*R. megarhinus*, Christ.).

The remains in question are in the Museum of the Royal College of Surgeons, and consists of between thirty and forty more or less broken portions of the teeth and of numerous bones of the skeleton. The greater number being hardly in a condition to afford satisfactory diagnostic specific characters, the remarks in the paper were limited to the teeth and to a perfect metacarpal bone, which appeared amply sufficient for the purpose.

The teeth mainly relied upon were the first or second upper molars (m^1 or m^2) of the right and left sides. Both the teeth were broken, but what was wanting in one was supplied by the other. The characters exhibited were shown to be unlike those of *R. tichorhinus*, and quite in accordance with those of *R. leptorhinus*. These were the thinness and smoothness of the enamel, the configuration of the dorsal surface, the form and size of the columns, and the disposition and relations of the "uncus" and "*pecten*" ("*crochet*" and "anterior combing-plate"), and the consequent absence of the characteristic "*tichorhine pit*" or *fossette*. The less strongly marked characters by which the teeth could be distinguished from those of *R. hemitœchus*, Falc., and *R. etruscus*, Falc., were also pointed out.

The metacarpal bone selected for the illustration of the diagnosis is 9½ in. long, and remarkable for the compression of the shaft and its comparative slenderness, as contrasted with the same bone in *R. tichorhinus*, specimens of which were exhibited on the table, and which, in no case within the author's knowledge, ever exceeds 7½ or 8 inches in length, and is proportionately much thicker than in *R. leptorhinus* or any other extinct species. The size and form of the bone also showed that the species could not be either *R. hemitœchus* or *R. etruscus*, for although the means of direct comparison with the third metacarpal of those species did not, to the author's knowledge, exist in London, its probable general dimensions and proportions could be deduced from those of the corresponding metatarsal, of which bone numerous specimens were available. It was further shown that the Oreston metacarpal exactly corresponded with those of *R. leptorhinus*, from Grays Thurrock, in the British Museum.

The determination of the species appears to be of considerable interest, inasmuch as it affords an additional instance of the occurrence in England of the great southern rhinoceros. This is also the only example of the discovery of that species, except in river or other deposits, either in this country or on the Continent.

Discussion.—The chairman remarked that at one time the Oreston Rhinoceros was referred to *R. tichorhinus*, but that Buckland, although mentioning the Rhinoceros, never gave it a specific name. The chairman also said that the Oreston fissures were not caves, but mere fissures which had been filled in; an entire skeleton occurred at one spot, and the animal must have fallen in.

Mr. Boyd Dawkins had been struck by the non-tichorine character of the Oreston specimens some years since. He confirmed Professor Busk's determination, and remarked that five British species of Rhinoceros are known, namely:—1. *R. Schleiermacheri*, from the Red Crag of Suffolk (in the Miocene at Darmstadt). 2. *R. etruscus*, from the Forest Bed = *R. Merckii* (Von Meyer). 3. *R. megarhinus* (Christol) = *leptorhinus* (Cuv.); but the latter name includes also *R. etruscus* and *R. hemitœchus*, so that the adoption of De Christol's name gets rid of a difficulty. 4. *R. hemitœchus*, and 5. *R. tichorhinus* = *R. antiquitatis* (Blum.).

Professor Busk, in reply, stated that Oreston was a fissure-cavern, and noticed the successive openings in 1816, 1821, and 1826. He did not agree with Mr. Boyd Dawkins in preferring the name *megarhinus* to Cuvier's *leptorhinus*. He did not know of the occurrence of two species of Rhinoceros at Oreston.

"On two Gneissoid series in Nova Scotia and New Brunswick, supposed to be the equivalents of the Huronian (Cambrian) and Laurentian," by H. Youle Hind, Esq., M.A.; communicated by Prof. Ramsay, F.R.S., F.G.S.—This paper described the relations of two Gneissoid series in Nova Scotia and New Brunswick, which have hitherto been regarded as intrusive granites and syenites, and have been thus represented on the published geological maps of those provinces. The author considered that these gneisses were in the main of Laurentian age, the Huronian or Cambrian rocks occurring only in patches over a vast area of Laurentian porphyroid gneiss.

The old gneiss was stated to be brought to the surface by three great undulations between the Atlantic coast of Nova Scotia and the Laurentian axis of America north of the St. Lawrence. These axes were rudely parallel to one another, and in the troughs which lay between them the Silurian, Devonian, and Carboniferous series occurred in regular sequence, the New Brunswick coal-field occupying the central trough. On the line of section, in the troughs to the north-west and south-east, the lower carboniferous was stated to be the highest rock series which has escaped denudation.

The gold-bearing rocks of Nova Scotia are of lower silurian age, and rest either on Huronian strata, or, where these had been removed by denudation, on the old Laurentian gneiss. The gold is found chiefly in beds of auriferous quartz of contemporaneous age with the slates and quartzites composing the mass of the series, which, in Nova Scotia, is 12,000 ft. thick; and the auriferous beds are worked, in one district or another, through a vertical space of 6,000 ft. Besides auriferous beds of quartz, intercalated beds and true veins are found to yield gold, and are worked.

A series of sharp and well-defined anticlinals ridge the province of Nova Scotia from east to west, while another series of low broad anticlinals of much later date have a meridional course. At the intersection of these anticlinals the gold districts are situated, because there denudation has best exposed the upturned edges of the auriferous beds of quartz, and rendered them accessible, sometimes exposing also the underlying gneiss. Plans of Waverley and Sherbrooke gold districts were exhibited, showing the outcrop of the edges of the slates and auriferous beds of quartz in semi-elliptical forms, with the gneiss at the base of the ellipse. On this ground it was suggested that a correct mapping of the gneisses of Nova Scotia would have an important influence on the development of the mineral resources of the province.

A plan of some of the lodes in the Waverley gold district showed the result of operations in 1869, subsequently to the publication of a geological map and sections of the district furnished to the Department of Mines by the author in 1868. Citations were made from the annual reports just issued of the Chief Commissioner of Mines and of the Inspector of Mines, confirming the correctness of the author's plans exhibiting the geological structure of Waverley, which is a type of all the Nova Scotian gold districts.

Discussion.—Principal Dawson spoke in confirmation of the fact that the Palæozoic rocks are underlain by Laurentian gneiss, &c., quite to the eastern coast of British North America, and stated that the same relation occurred in Newfoundland, and had been traced southwards into Massachusetts. He confirmed Mr. Hind's views generally, and stated that the lower silurian of Nova Scotia includes no great fossiliferous limestone, like that of the interior of North America. The supposed *Eozoon* discovered by Dr. Honeyman was probably distinct from E. *canadense*, but was certainly a Foraminiferal organism allied to *Eozoon*; but as *Eozoon bohemicum* is of later date than E. *canadense*, the presence of *Eozoon* did not necessarily indicate Laurentian age.

Prof. Ramsay suggested that other organisms besides *Eozoon* aided in building up these great calcareous masses. He inquired as to the mode of occurrence of gold, and suggested that the gold is obtained at the anticlinals merely because the exposure is better, and that it will be found to pervade the synclinals also.

Mr. Henry Robinson had visited the Waverley district in company with Prof. Hind, in the winter of 1868, at which time the mining on the lodes referred to in the map before the society was at a stand-still,

the lodes having been lost by reason of a fault. He thought it was very satisfactory to find that the explorations of Prof. Hind, and the theoretical position which he assigned to the lodes, had been completely verified. Mr. Robinson also stated that gold is being mined in the synclinals by sinking shafts and driving cross-cuts.

Mr. Hind remarked that all the lower silurian in Nova Scotia was auriferous, and that the gold was derived from the underlying Laurentian rocks. He stated that Sir W. E. Logan had indicated an auriferous zone in the Laurentian of Canada. Gold was finely distributed in the slates of Nova Scotia, as in Victoria, in the neighbourhood of lodes, according to Mr. R. Brough Smyth.

The following specimens were exhibited to the meeting :—Teeth and bones of rhinoceros from Oreston ; exhibited by G. Busk, Esq., F.R.S., F.G.S., in illustration of his paper.

ZOOLOGICAL SOCIETY.

April 28th.—John Gould, Esq., F.R.S., V.P., in the chair. The secretary read some notes on the principal additions to the society's menagerie during the month of March, and called particular attention to four burrowing owls, presented by G. Wilks, Esq., C.M.Z.S., and to a wood-loving antelope (*Cephalophus sylviculträx*), obtained by purchase.

Mr. J. E. Harting, F.Z.S., exhibited an unusually fine specimen of the dusky redshank (*Totanus fuscus*) in summer plumage, recently killed near London.

The Rev. H. B. Tristram exhibited two skins of *Salicaria melanopogon*), a rare European warbler, obtained near Ettawah, north of Agra, being the first recorded occurrence of this species in Central India.

Dr. E. Hamilton communicated an extract from a letter addressed to him by his nephew, Captain Hamilton, lately commanding a detachment at Port Blair, concerning the true locality of the so-called Andaman monkey, now in the Society's Gardens, which was stated to have been imported into the Andaman Islands from Burmah.

A letter was read from Dr. John Anderson, F.Z.S., of the Indian Museum, Calcutta, announcing that he had obtained a specimen of the dolphin of Irrawaddi, which turned out to be a species of the genus Globiocephalus.

Mr. St. George Mivart read a memoir on the axial skeleton of the tailed Batrachians, containing observations of the development and mode of formation of the spinal column of these animals.

A communication was read from Mr. Gerard Krefft, C.M.Z.S., containing the description of a new and very remarkable animal, allied to Lepidosiren, recently discovered in the freshwaters of Queensland. Mr. Krefft considered this animal to be an amphibian, and referred it to the genus Ceratodus of Agassiz, proposing to call it *Ceratodus forsteri*, after Mr. Wm. Forster, its discoverer.

Mr. R. Swinhoe, F.Z.S., read a paper on the mammals of Hainan, as observed during his recent visit to this island. The number of species enumerated was twenty-one, amongst which was a hare, believed to be undescribed, and proposed to be called *Lepus hainanus*.

A second communication was read by Mr. Swinhoe, being a list of reptiles and batrachians collected in the same island, with notes on their habits. The species had been determined by Dr. Günther.

Mr. D. G. Elliot, F.Z.S., read a paper on some new genera and species of birds belonging to the families Formicariidæ, Pachycephalidæ, and Sylviidæ. These were proposed to be called *Xenorhynchus pachycephaloides* (from New Caledonia), *Clytoctantes alixii* (from Ecuador), and *Calamoherpe subflavescens* (from Dahouria).

Messrs. Sharpe and Dresser read a paper on some new or little-known points in the economy of the common swallow (*Hirundo rustica*). The authors drew special attention to the changes of plumage through which this species passed during its residence in Southern Africa.

Mr. G. B. Sowerby communicated descriptions of forty-eight new species of shells from various localities.

ANTHROPOLOGICAL SOCIETY OF LONDON.

May 3rd.—Dr. R. S. Charnock, V.P., in the chair. Moore A. Cuffe, Esq., LL.D., 9, Camden-crescent, Bath, was elected a fellow.

A paper was read by Major W. Ross King, F.R.G.S., F.S.A.S., on the "Aboriginal Tribes of the Nilgiri Hills," namely, the Todas, Khotas, Erulas, and Kurumbas, especially noticing the former, as being the most singular and important. The author, who was three years among these tribes, described in turn the characteristic features and peculiarities of each, with detailed information as to their very curious social customs, and religious rites and ideas ; showing the marked distinctions existing in every point between tribes occupying one and the same area, and in constant communication with each other ; pointing out the fact that each people retained its own language ; and their remarkable isolation from the surrounding enormous population of the plains. The striking similarity between the rites, practices, and monuments of the Todas and those of the ancient Celts of Britain was shown ; a passing allusion was made to the evidences of an early western migration as traceable through intervening countries in the existence of similar rites and customs ; and the presence on the Nilgiri hills of Druidical circles, cromlechs, kistvaens, and tumuli, was described, precisely similar to those so well known in our own country. While commenting on the analogies thus apparent between the ancient Celts and some of these hill tribes, the author took occasion also to remark on their similarities in other respects to the Jews of old, to the Kaffirs, and to the ancient Romans, not as being likely to lead to any theory of origin in those quarters, but as possibly qualifying the reliance to be placed on every point of Celtic resemblance. In conclusion, the author, who illustrated his paper by the exhibition of several drawings, and of some interesting native ornaments, &c., summed up the various theories prevailing as to the probable origin of these tribes, of whose history we are still so ignorant, and recommended the subject to the society as one worthy of their investigation.

A discussion ensued, in which the following gentlemen took part :—Mr. Lewis, Mr. Bouverie-Pusey, Captain Blair, Dr. Seemann, Mr. Dendy, and the chairman.

At the next meeting a paper will be read by Mr. Henry F. Chorley on "Music considered as a racial characteristic."

ENTOMOLOGICAL SOCIETY OF LONDON.

May 2nd.—Mr. A. R. Wallace, president, in the chair. After some interesting exhibitions of *Lepidoptera*, by Mr. Hewitson ; of *Hymenoptera*, by Mr. F. Smith ; of *Neuroptera*, by Mr. M'Lachlan ; and of *Coleoptera*, by Mr. Bates and Mr. G. R. Crotch, the following papers were read :—"On Equatorial *Lepidoptera*," by Mr. Hewitson ; "Descriptions of new Genera and Species of *Odonata*," by Mr. M'Lachlan ; "On new *Copridæ*," by Mr. Bates ; and "On Australian *Curculionidæ*," by Mr. Pascoe.

"A Catalogue of British Neuroptera," compiled by Mr. M'Lachlan for and published by the society, was on the table.

ROYAL INSTITUTION.

Annual Meeting, Monday, May 2nd.—Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., president, in the chair. The annual report of the committee of visitors for the year 1869 was read and adopted. The books and pamphlets presented in 1869 amounted to 255 volumes, making, with those purchased by the managers, a total of 388 volumes added to the library in the year, exclusive of periodicals. Forty-seven new members were elected in 1869. Sixty-three lectures and nineteen evening discourses were delivered during the year 1869. Thanks were voted to the president, treasurer, and secretary, to the committees of managers and visitors, and to the professors, for their services to the institution during the past year. The following gentlemen were unanimously elected as officers for the ensuing year :—President, Sir Henry Holland, Bart., M.D., D.C.L., F.R.S. ; treasurer, William Spottiswoode, Esq., M.A., F.R.S. ; secretary, Henry Bence Jones, M.A., M.D., F.R.S. Managers : John J. Bigsby, M.D., F.R.S., F.G.S. ; the Earl of Derby, M.A., LL.D., F.R.S. ; William Bowman, Esq., F.R.C.S., F.R.S. ; Charles Brooke, Esq., M.A., F.R.S. ; George Busk, Esq., F.R.C.S., F.R.S. ; Warren De la Rue, Esq., Ph.D., F.R.S. ; John Peter Gassiot, Esq., F.R.S. ; John Hall Gladstone, Esq., Ph.D., F.R.S. ; Sir John Lubbock, Bart., M.P., F.R.S., F.G.S. ; George Macilwain, Esq., F.R.C.S. ; Sir Roderick I. Murchison, Bart., K.C.B., F.R.S. ; William Pole, Esq., M.A., F.R.S. ; Lieut.-Gen. Sir Edward Sabine, R.A., K.C.B., Pres., R.S. ; the Marquis of Salisbury ; Sir Charles Wheatstone, D.C.L., F.R.S. Visitors :—William Ernest Browning, Esq. ; John Charles Burgoyne, Esq. ; William Dell, Esq. ; Thomas Williams Helps, Esq., M.A. ; Thomas Hyde Hills, Esq. ; Alfred Latham, Esq. ; William Martin, Esq. ; Thomas Lee, Esq. ; Edward Henry Moscrop, Esq. ; Rev. Cyril W. Page, M.A. ; Edmund Pepys, Esq. ; the Lord Josceline W. Percy ; Basil Woodd Smith, Esq. ; Thomas Spencer Wells, Esq. Michael Wills, Esq.

GEOLOGIST'S ASSOCIATION.

May 6th.—Professor J. Morris, F.S.S., president, in the chair.—Notes on the Geology of the Country in the neighbourhood of Swanage, by T. D. Bott, F. G. S. The author described the various strata between Durlstone Head, S.W., and Handfast Point, N.E. The Portland beds were the first noticed, they dip N.E., and form the cliffs at Durlstone Head. They were shown to be capped by the dirt-bed similar to that of Lulworth and Portland. The author went on to describe the various beds of Purbeck strata, which extend from the Point to Swanage, whence they pass up into the Hastings sands. Quarries worked in the Purbeck beds were described, and the various building stones and marbles were mentioned. The beds in Durlstone

[illegible] were shown to be much faulted. Touching lightly on the Hastings sands, the author then proceeded to trace the passage to the Wealden, passing up into the Hythemarsh, the Upper Greensand, and thence to the Chalk of Dalmer Downs. The beds of chalk at Dalmer Downs were shown to be a most curious junction, and an extensive fault at Handfast Point was referred. The author concluded by appreciating to the causes of the existence of the series of beds and showed the similarity of beds at Handfast Point with those in the Isle of Wight and Whitecliff Bay. The author gave a list of the fossils which he had procured, including part of a small crocodile.

"On the Thanet Chalk," by J. Dowker, F.G.S. Referring to Mr. Phillips's description of the chalk of Kent as the most accurate given of the chalk of East Kent, which little had been added except Mr. Whitaker's paper of the chalk of Thanet, Mr. Dowker pointed out that the chalk there described was present between Kingsdown and Waghorn presenting the same features as the Margate chalk, which, as Mr. Whitaker had shown, was superior to the chalk of Ramsgate. Mr. Dowker then gave a detailed description of the bed of chalk yielding up the characteristic elements of flints, which led Mr. Chapman erroneously to consider it an equivalent of the lower chalks. The chalk of Thanet being on an anticlinal, resulting from St. Margaret's to Ramsgate, a section showing the true position of this chalk was given, and an ideal section the heights above the sea-level being taken from the Ordnance survey, was exhibited from Folkstone to Pegwell in Thanet. In this section Mr. Dowker classified the chalk of Kent, beginning with the lowest beds, as—1st, grey chalk; 2nd, flintless chalk; 3rd, Lower chalk; 4th, St. Margaret's chalk; 5th, Ramsgate chalk 6th Margate chalk; the characteristic features of each of these divisions being best examined at the cliff sections there exhibited. These divisions, compared with Phillips's coast sections, corresponded with his—1st, grey chalk; 2nd, chalk without flints; 3rd, chalk with few flints; 4th, chalk with interspersed flints; 5th, part of the same with few organic remains (possibly a part of the Margate chalk), which he had not described, owing, doubtless, to the fact that this bed is much denuded in the coast section near Walmer; for this reason Mr. Dowker had thought best to give a section in a direct line from Folkstone to Foreness Point. It was shown that the chalk of Canterbury differed somewhat from the highest bed of chalk, though capped by the Tertiaries, in having more numerous flints in it. The Margate chalk was characterized by the presence of *Ananchytes ovata*, *A. pyramidalis*; *Galerites albogalerus*, several varieties; *Ammonites leptophyllus* (?); and another large ammonite, *Belemnites ultimus*, *B. mucronatus* and *Millepora*, very abundant. In the Ramsgate chalk several species of Cidaris are abundant, also *Spondylus spinosus*. Fossils from the upper part of the Ramsgate chalk correspond with those obtained from Gravesend and Northfleet. The apparent conformity of the Margate chalk with the Tertiaries was noticed, but the tabular layer of flint generally present at the top of the former, was accounted for by its subsequent formation to the deposition of the Tertiaries. A general comparison was given of the chalk sections of Dover, Norwich, Diss, Lyme Regis, and the Isle of Wight, and it was shown that the difference in their thickness was not due altogether to the denudation of the upper beds, but that the lower had thinned out, consequently the relative total thickness of the strata could not be taken as a guide to the denudation to which they had been subjected. Mr. Whitaker's subdivisions of the chalk and a well section at Margate were given, showing that the chalk rock had been pierced to marly chalk below. A list of the fossils of the Margate chalk collected by the author was appended.

VICTORIA INSTITUTE.

An ordinary meeting was held on Monday evening last, at 8, Adelphi-terrace; Rev. Dr. Thornton, vice-president, in the chair. A paper was read on "Comparative Psychology," by Mr. C. J. Morshead. The following gentlemen took part in the discussion:—Rev. C. A. Row, Rev. J. B. Owen, Dr. C. Haughton, Mr. Reddie, Rev. J. James, Rev. Sir Tilson Marsh, Rev. C. Graham, and the chairman.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Annual Meeting, April 19th.—J. P. Joule, D.C.L., LL.D., F.R.S., &c., president, in the chair. Mr. Charles Lowe was elected an ordinary member of the society. The Report of the Council was read by one of the secretaries.

Mr. Binney, F.R.S., on behalf of Mr. Mortimer L. Tait, exhibited some specimens of Coprolites from a quarry at Ashwell, near Baldock, Herts.

"On Infant Mortality in Manchester," by Joseph Baxendell, F.R.A.S.—It has been repeatedly and very confidently stated that the high death-rate of Manchester and other towns in the cotton-manufacturing districts is due to the mortality among infants and young children being relatively much greater than in large towns in other parts of the country; and writers in newspapers and serials have, at various times, taken up the statement and commented in very severe terms, upon the negligent and unfeeling conduct of Lancashire and especially Manchester mothers in using supposed by the higher wages they can earn in the cotton mills to leave their children during working hours in the under nurture of careless nurses, and thus deprive them of the natural sustenance and maternity care which they so much require. A few months ago this serious charge against Manchester mothers was repeated in a lecture delivered by a gentleman holding an official position, who moreover added that it was the principal reason why the efforts of health committees and sanitary officials in Manchester and other cotton-manufacturing towns had been attended with so little success and had failed to make any reduction in the death-rate. As however no facts were adduced by the lecturer in support of the statement, it occurred to me that it had probably originated in a hasty and superficial examination of the mortality returns, and that it might be useful and instructive to ascertain the exact amount of infant mortality, and the effect it had on the general death-rate of Manchester and several other large towns where little or no cotton-manufacturing is carried on. From the facts in which the mortality returns are given in the Registrar-General's Reports, this could readily be done, and selecting the towns of Birmingham, Bradford, Dudley, Sheffield, Wolverhampton, Leeds, Newcastle-upon-Tyne, Nottingham, Stoke-on-Trent, Stourbridge, and Leicester, for comparison with Manchester: and taking the returns for the seven years 1861-67, I was surprised to find that the portion of the total death-rate which was due to infant mortality was relatively less in Manchester than in any of the other towns. Thus out of every 1,000 deaths of males at all ages, the number due to infants under one year of age was:—

Dudley	347	Stourbridge	298
Leicester	341	Sheffield	296
Bradford	322	Leeds	285
Stoke-on-Trent	309	Birmingham	277
Nottingham	307	Newcastle-upon-Tyne	274
Wolverhampton	304	Manchester	253

And, including young children up to five years of age, the numbers are:—

Dudley	591	Bradford	507
Wolverhampton	526	Sheffield	505
Stourbridge	518	Leeds	485
Leicester	517	Nottingham	475
Stoke-on-Trent	516	Newcastle-upon-Tyne	471
Birmingham	506	Manchester	465

I have also compared Manchester with the five large cotton-manufacturing towns of Ashton, Bolton, Blackburn, Oldham, and Preston. The results are:—

	Under 1 Year of Age.	Under 5 Years of Age.
Preston	312	503
Ashton	297	485
Oldham	287	499
Bolton	276	493
Blackburn	272	487
Manchester	253	465

In all the lists the numbers for Manchester are much less than those for any of the other towns, and in some cases the differences are very striking. It is clear therefore that the stigma which has been cast upon the mothers belonging to the working-classes of Manchester is most undeserved; and that, in fact, infants and young children are better cared for and attended to in Manchester than in any other leading manufacturing town in England. It is also evident that excessive infant mortality is not the cause of the alarmingly high death-rate of Manchester, since a much larger proportional number of deaths of infants and young children takes place in other towns where the general death-rate is decidedly lower. Some other cause must therefore be sought out to account for the failure of the attempts made by the sanitary authorities to reduce the death-rate of Manchester.

Mr. Baxendell, referring to the paper he had read at the last meeting, said that as considerable surprise had been expressed at the facts he had given, showing that the carrying out of the schemes of the sanitary authorities throughout England had produced no diminution in the general rate of mortality, he had since examined the mortality returns for Scotland, for the ten years 1859-68, and found that the average annual death-rate during the first five years 1859-63 was 21·5 per 1,000 persons living; and during the last five years, 1864-68, it had risen to 22·5. It appeared, therefore, that so far as ten years' experience extended, our present sanitary system had failed quite as signally in Scotland as in England to produce any improvement in the state of the public health.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

April 14th.—Mr. Glaisyer, vice-president, in the chair. The receipt of the *Proceedings of the Eastbourne Natural History Society*, and of Scientific Opinion, from the editor, was announced.

The claims of the "Sars'" testimonial fund were brought before the meeting by the president, and a subscription made among the members present, the society not having power to vote money for the purpose.

The president, Mr. T. H. Hennah, read a report "On Soundings made by Sir E. Parry in 1818."—These soundings were purchased some years since among the geological specimens of Sir E. Parry from his widow, by Mr. J. Cordy Burrows, of Brighton, who deposited the geological specimens in the Brighton Museum, and gave the soundings to Mr. Peto. Attention being directed to sea-soundings by the discoveries of last year, they were placed in Mr. Hennah's hand in January to examine microscopically and report to the society on their contents.

The soundings were taken in Davis's Straits and Lancaster Sound between 68° N. and 71° 15′ N. lat., and 73° W. and 78° 34′ W. long., at depths between 22 fathoms and 1,058 fathoms. Those under 58 fathoms contained nothing but stones and corals. Some of the stones had evidently been rubbed by the action of a strong current; those from 201 fathoms were much less disturbed, and consisted of much sandy material. From 674 fathoms there was an almost absence of inorganic *débris*, and plenty of the testa of arenaceous foraminiferæ. In all the deep ones Diatomaceæ were very plentiful; sponge spicules and arenaceous foraminiferæ also abounded; but Polycystinæ and cretaceous foraminiferæ were but sparsely found. Casts similar to those found in the greensand were also to be met with. In some from Lancaster Sound were lumps found with borings of annelids. He had also found some highly organized spicules, which he had not yet identified. At one of the microscopical meetings the slides would be exhibited. He much regretted they were not examined earlier, as they would then have preceded not succeeded the discoveries of Carpenter and others, who, by the deep-sea soundings recently made, had opened out new ideas of life at great depths. Reference was then made to what had been done by Carpenter, Jeffreys, Thomson, and others in adding to our knowledge of the conditions of existence at great depths, and allusion was made to the nature of the animals and their economy, together with the chemical conditions at great depths, and the fact pointed out that changes of *fauna* depended not on latitude, but on the variations in the bottom temperature.

Mr. Wonfor, hon. sec., announced that the *Moss Flora of Sussex* was ready for distribution among the members, and that duplicate copies could be had, at a nominal price, by applying to him at 38, Buckingham-place, Brighton.

BOSTON (U.S.) SOCIETY OF NATURAL HISTORY.

April 20th.—Mr. R. Bliss exhibited a copy of a steel-plate engraving, made by Mr. W. Holden, of Charleston, by means of the ordinary sensitive paper of photographers. The paper is laid upon the engraving to be copied, covered with a glass plate, and the whole exposed to the direct light of the sun for one hour, and the paper afterwards thoroughly washed, to remove the nitrate of silver. A perfect copy of the engraving is thus produced, which being, of course, in the negative, must be re-copied if a positive is desired.

Mr. W. T. Brigham stated that he had obtained the same result in a much cheaper manner, by making a sensitive paper by means of a solution of bichromate of potash and sulphate of copper, which is placed upon the engraving, as in the former experiment, and exposed to the sunlight for fifteen minutes, the surface to be afterwards washed with a solution of nitrate of silver. He had in his possession copies of engravings made in this way, which had kept perfectly for ten years.

Mr. W. T. Brigham explained to the society the phenomenon of geysers, illustrating the action of the famous Strokkur Geyser of Iceland, by an experiment performed with a large shallow metal dish, having a pipe extending from it beneath the floor of the auditorium, in which the water was heated. On placing a cork in the mouth of the tube the tension of the steam soon violently ejected it, and a column of water and steam shot up to the ceiling of the room.

Professor N. S. Shaler gave an account of a discovery he had recently made of what he considered to be the terminal moraine of an ancient glacier near the Charles River in Watertown, about six miles from Boston. One end of the moraine rests upon the flank of the ridge of rock which defines the valley of the Charles River; the other end is cut by the road which runs along the bank of the river. Across the river is another moraine, or a continuation of this one, which ends against the rocky ridge bounding the valley of the river on the other side. A section of the moraine, made by a railroad cut, exhibits the usual moraine structure of broken rocks imbedded in finer material. Professor Shaler considered it as the terminal wall of a great ice-sheet which had once filled the valley of the Charles River. The speaker then called attention to the drift material which caps most of the low hills lying around Boston, and showed that it differs from the moraine just described, in that the imbedded stones lie with their major axis more or less closely parallel to the horizon. He believed that this drift material resulted from the melting of the glaciers, when the detritus was washed down and deposited in a semi-stratified condition.

Mr. W. H. Niles remarked that he had not seen the moraine referred to by Professor Shaler, but he did see how it was possible for a moraine to be found in this position, when the whole surface of the country about Boston showed such unmistakable marks of the post-glacial action of water. He instanced the case of a hill in Summerville, where the regularly rounded top was quite bare of drift material, and whose eastern slope, for at least 50 ft. above water-level, bore undeniable evidence of aqueous erosion. The speaker also referred to the stratified gravels in the valley of the Charles River, which could not have retained their stratified structure had the ice filled the valley of the river as Professor Shaler supposed. He stated, moreover, that the boulders in the neighbourhood of the moraine were not lithologically different from the rock in the vicinity, and had not therefore been brought from a distance.

Professor Shaler, in replying to Mr. Niles, said that he believed there had been two periods of ice action. At the end of the first glacial period the semi-stratified deposit upon the Summerville and Chelsea hills had been laid down; after which the land had subsided and the sea had formed the stratified gravel-beds in the river valley, and eroded the side of the hill referred to by Mr. Niles. Then the land had risen and another period of glaciation had followed, which left the moraine he had observed at Watertown. He did not think this second ice period had been long, and referred to some rocks in a quarry near Boston, where it was evident that the ice could not have worn the rock down more than a few inches.

After some further discussion, the society proceeded to the business of the meeting, which was to take final action upon the proposed constitutional amendment, substituting a committee of three for single curators in each department of the museum, the different committees together forming the managing board or council. After some discussion the amendment was unanimously adopted.

FOREIGN ACADEMIES.

THE FRENCH ACADEMY.

Paris, May 2nd.—M. Liouville informed the meeting of the death of M. Lamé, one of the most eminent members of the Academy. M. Lamé was Chairman of the Section of Geometry, and had been elected in 1843 in place of M. Puissaint.

The correspondence of the day was opened by M. Dumas, who brought forward some papers.

M. Morren, Professor in the Faculty of Science at Marseilles, made some interesting remarks on the combustion of the diamond in various gases. When the diamond has been heated in a platina tube, through which some hydro-carburetted gas has passed, the diamond becomes covered with an adhering black layer, which does not alter the diamond, and can easily be removed by a simple elevation of the temperature. This elevation should not be carried too far, however, as it would change the poliah of the stone and its brilliancy; but if, instead of such a gas as the above, pure dry hydrogen is passed through the tube, the diamond may be submitted to a higher temperature without in any way altering its appearance. If carbonic acid be used, this gas is decomposed, and oxygen and carbonic oxide are formed in the tube. But this decomposition takes place when there is no diamond in the tube, and is, therefore, merely an effect of the temperature. When the diamond is heated in oxygen, it burns, being surrounded by a sort of halo; and after a certain time it completely disappears. If the diamond be examined with a microscope before it has entirely disappeared, it is seen that the faces of the crystal instead of being a plane, are covered with a number of small elementary facettes.

M. Weil brought forward a note on the estimation of copper by means of the volumetric method; M. Béchamp a paper on the preparation of pyrotartric acid; M, Desains a note on calorific spectra; M. Lecoq de Boisbaudran a note on luminous spectra of metallic compounds, and especially of the alkaline iodides; M. Dupré a note on the dissolving power of the salts of mercury.

M. Duchemin made a communication on the mortality of carp, due to the attacks of toad. He brought forward a number of observations in support of what he advanced.

M. Mermet, Director of the Waters of Contresceville (Vosges), mentioned a piece of water in which it was formerly impossible to preserve any carp on account of the presence of toads.

M. Poitevin, a chemist well-known to the Academy, mentioned an aquarium in the department of Sarthe, where carp are attacked each year by the reptile.

M. Sauvalle also asserted the hostility of the toad. He said that the Abbé Caillet, Curé of Rosoy (Haute Marne), wrote to him informing him that he had been witness to some facts analogous to those already mentioned by M. Sauvalle.

M. E. Becquerel presented a paper, in the name of M. Bouchotte, on the relation of the dynamical work to the electricity produced in a Holtz-machine.

M. Duméril analyzed verbally the results of some anatomical observations made by M. Emile Moreau on a very small fish, of the organization of which very little is known. This fish is the *Amphioxus lanceolatus*, and M. Moreau has demonstrated it to be a vertebrate.

M. Brongniart presented a paper, by M. Arthur Gris, on the persistence of the medulla in vegetables.

M. Des Cloiseaux communicated the details of a crystallographic and optical examination which he had made on some new platinum derivatives of the phosphorus bases, on which M. Cahours spoke at the last meeting.

M. Des Cloiseaux presented a paper, by M. Pisani, on certain minerals which have been found mixed with the blue and green carbonate of copper, in the mines of the department du Var.

M. Le Verrier placed on the bureau of the Academy some papers, one by M. Breton de Champ, and another by the Abbé Aoust.

NOTES AND MEMORANDA.

Artificial Production of Ice in India.—M. Janssen, in a paper in *Cosmos*, April 23, relates that, in many parts of the Indian Continent, the natives dig shallow pits in such localities which are quite freely open to the sky and distant from trees. The pits are lined with straw, and upon the straw are placed dishes (made of a very porous earthenware) filled with water. During the calm and clear nights prevailing during the period from November to the end of February, the water placed in the dishes freezes, yielding a solid cake of ice, while the temperature of the air is +10°. Dr. Janssen has investigated this curious subject experimentally, and has found that the freezing is principally due to the radiation during the night; but the evaporation of the water, aided by the porosity of the earthenware employed, is not to be overlooked at the same time.

Fluids in Crystals.—Spectrum analysis has been applied by Vogelsang and Geissler to the difficult question of determining the chemical nature of the fluid found inclosed, in minute quantity, in the cavities of certain quartz-crystals. Fragments of quartz, says the *Chemical News*, were placed in a small retort, which was connected with an air-pump and exhausted; then, by the application of heat, the quartz decrepitated, and the evolved vapour was examined in a Geissler-tube. The presence of carbonic acid was thus abundantly proved, and this was confirmed by the turbidity which it produced in lime-water.

Discovery of the most Ancient Monument of Paris.—Without entering into details, which our readers may have seen from the daily papers, concerning the discovery recently made at Paris of a very well preserved amphitheatre of ancient Lutetia, we only desire, says the *Chemical News*, to rectify an error some of our daily contemporaries have made on this topic, by stating that the building alluded to is of later date than the Thermæ of Julian, in the Cité of Paris. The fact is that the Amphitheatre is at least two centuries older than the Thermæ.

SCIENTIFIC DIARY.

WEDNESDAY, May 11th.

Royal Microscopical Society, 8 p.m. "On Early Reminiscences of the Microscope," by Dr. Bowerbank. "On a New Binocular and Stereoscopic Microscope," by Mr. Samuel Holmes.
Epidemiological Society, 8 p.m. Special Meeting to consider further Resolutions of the Medico-Chirurgical Society respecting the Amalgamation of Societies.
Society of Arts, 8 p.m. "Railways for India," by Mr. W. P. Andrew.
Royal Geological Society, 8 p.m. "Structure and Affinities of Sigillaria, Calamites, and Calamodendron," by Dr. Dawson. "Lower Silurian Trilobites," by Mr. E. Billings. "Notes on the Geology of Arisaig, Nova Scotia," by Rev. D. Honeyman.
Royal Literary Fund, 3 p.m.
Royal Society of Literature, 4.15 p.m.
Archæological Association, 8 p.m.

THURSDAY, 12th.

Royal Society, 8.30 p.m. Dr. A. Waller, F.R.S., will deliver the "Croonian Lecture," on the Results of the Method (introduced by the lecturer) of Investigating the Nervous System, more especially as applied to the Elucidation of the Functions of the Pneumogastric and Sympathetic Nerves in Man.
London Institution, 7.30 p.m.
Society of Antiquaries, 8.30 p.m. "Recent Discoveries at Rome," by Mr. J. H. Parker.
Zoological Society, 8.30 p.m. "Anatomy of Certain Kingfishers," by Dr. Cunningham. "Taxonomic Characters afforded by the Muscular Sheath of the Œsophagus in Sauropsida, &c," by Prof. G. Gulliver. "Myology of *Platydactylus Japonicus*," by Mr. A. Sanders. "Hirundinidæ of the Æthiopian Region," by Mr. R. B. Sharpe.
Royal Society Club, 6 p.m.
Royal Institution, 3 p.m. "Electricity," by Professor Tyndall.
Mathematical Society, 8 p.m. "Mechanical Description of a Nodal Bicircular Quartic," by Prof. Cayley. "Concerning the Ovals of Des Cartes," by Mr. S. Roberts.

FRIDAY, 13th.

Astronomical Society, 8 p.m.
Royal Institution, 8 p.m. "On Descent of Glaciers," by Canon Moseley.
Quekett Microscopical Club, 8 p.m.
Clinical Society, 8 30 p.m. "On Injury to the Liver," by Dr. John Harley. "On Stricture of the Œsophagus," by Dr. Morell Mackenzie. With other papers. The Meeting will afterwards be made Special, to consider the Amalgamation Scheme Resolutions.
United Service Institution, 3 p.m. "Military Telegraphy and Signalling," by Capt. R. H. Stothard, R.E.
Quekett Microscopical Club. Excursion to Carshalton. To meet at London Bridge Station, (South London Line) at 2 o'clock.

SATURDAY, 14th.

Royal Botanic Society, 3.45 p.m.
Royal Institution, 3 p.m. "Astronomy of Comets," by Prof. Grant.

SUNDAY, 15th.

Sunday Lecture Society, 8 p.m. "On Socrates, his Ethics and Theology," by Professor J. S. Blackie.

MONDAY, 16th.

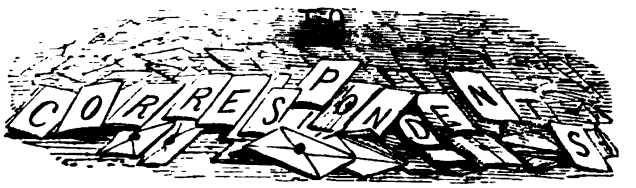
Institution of British Architects, 8 p.m.
London Institution, 4 p.m.

TUESDAY, 17th.

Institution of Civil Engineers, 8 p.m.
Statistical Society, 8 p.m.
Pathological Society, 8 p.m.
Anthropological Society, 8 p.m.
Birmingham Natural History and Microscopical Society, 7 30 p.m. "Notes on the Post-tertiary of Norway," by Rev. H. W. Crosskey.
Royal Institution, 3 p.m. "Moral Philosophy," by Prof. Blackie.

WEDNESDAY, 18th.

Society of Arts, 8 p.m.
Pharmaceutical Society, 8 p.m.



PHOTOGRAPHS OF NEW ZEALAND.—"A. R."—They shall be left at the office, and may then be called for. It is not usual to return specimens of the kind, but luckily they were not given away, and so we shall have much pleasure in restoring them to our correspondent.

MR. PROCTOR'S LECTURE.—Our anonymous correspondent shall be gratified. It shall appear in due course.

MICROSCOPE AND ACTINOPHRYS.—"C. S. W."—Thanks. Send the MS. by all means. You shall receive a proof in due course.

IRISH NAMES.—Messrs. M'Glashan & Gill's communication is to hand. The work shall be noticed in an early number.

TWO LIVING CORALS.—"H. E."—Go to Mr. King's (naturalist), 190, Great Portland-street. He has some beautiful specimens of two corals in full healthy life in one of his aquaria.

NATURALIST.—"G. H. K."—Card has been received, and shall be attended to. We cannot, however, engrave the block. If "G. H. K." will send the block, a notice will be given.

ILLUSTRATED HANDBOOK OF CALIFORNIA.—"A. E."—Apply to Messrs. Simpkin & Marshall, in Paternoster-row.

POTATO CULTURE.—If "W." would put his observations into the compass of a moderately-sized paragraph, we will gladly do what we can for him.

SUNDAY LECTURE SOCIETY.—"W. H. D."—The omission was simply accidental. The day and subject were inserted in our last diary. If you wish a special notice, you should send an abstract of the lecture, which we shall have much pleasure in publishing.

CORINTHIAN CLUB.—"Inquirer."—This is to be opened in Langham-place, and is likely to meet the wants of those who projected the Scientific Club.

ZOOLOGICAL COMMUNICATIONS.—"P. H. G."—Accept our best thanks. The proof was forwarded. We shall be very glad to publish similar papers in future.

ILLUSTRATIONS OF BOTANY.—"W. A. K. J."—The specimen was received. It seems excellent, and shall have a notice in an early number.

LUNAR CHANGES.—"W. R. B."—Your letter and enclosure reach us just as we go to press, and too late for insertion in this issue. Your request shall be complied with. The letter in our next.

WEDNESDAY, MAY 18, 1870.

THE SUNDAY LECTURE SOCIETY.

WE have hitherto abstained from any general comment on the conduct of this newly established institution, partly because of its supposed connection with what were known as "Recreative Religionists," and partly because the Society was on its trial, and we wished to wait ere we offered any definitive opinion. It is now, however, our pleasant duty to speak of the labours of the new body, and to speak of them in very favourable terms. Whatever may have been the motive of those who originally projected the Sunday lecture movement it is not for us to inquire. Even the best achievements are often the fruit of unworthy influences; and, be the intentions of the Sunday Lecture Society what they may, there is no longer a doubt that the movement has been productive, so far as we can judge, of very satisfactory results. The subjects of the lectures have been chosen with discrimination, and the names of the lecturers have been a sufficient guarantee of their ability to discharge the task allotted to them.

At first it was imagined, especially by those opposed to the scheme, that it was the intention of the promoters to evade the Sunday statutes by giving a sort of pseudo-religious character to the meetings, by opening them, in fact, with a prayer or a hymn, or something of that kind. But, though a few of the Sunday-movement people were in favour of this false compromise, we are glad to find that the idea has been abandoned, and that the society has constituted itself into a scientific institution, something on the plan of the Royal Institution, but having the peculiarity of doing its work on the Sabbath.

A great many people, too, supposed that the aim of the society was the spread of either atheism, deism, or materialism, in some shape or form. And the fact that certain well-known men of science, whose religious ideas are not regarded as orthodox, were selected to give the earlier lectures, lent some countenance to this notion. But it is perfectly clear, both from the expressed views of the Society and from the tone of the lectures, that this has not been the desire of the Society. Its object has rather been to afford to those of the public who may not care to spend the Sabbath evening in a house of worship, an opportunity of learning the great truths of science, which their occupations on week-day evenings preclude their hearing. In this respect we think the Society has proved itself successful; and if success is to be estimated by numbers, the crowded audiences, especially of working men, are sufficient testimony to this.

But if we wanted a still further example of the honest intentions of the Society, if we desired to show that the Society was determined to select its lecturers in such a manner as to give both the Spiritualists and Materialists the means of hearing the arguments on their respective sides in Science and Mental Philosophy, we need only point to the lecture of Sunday evening last as a striking illustration. Surely an Association which engages the services of that somewhat hot-headed orator, Professor Blackie, with a view to expound the principles of metaphysics, and to discuss the mental character of Socrates, cannot be accused of any bias toward either atheism or any other *ism* (unless Patriotism) of an objectionable character! It would be impossible for the Sunday Lecture Society to have selected any lecturer, the whole tenor and tone of whose philosophy are more opposed to modern psychology than the Scotch Professor. Most people would admit this *à priori*; but even those who knew nothing of Professor Blackie's philosophy, and who heard him on Sunday last—in the intervals of his beer-drinking—launch out into abuse of Stuart Mill and all who belong to his school, must have been convinced that the Society which permitted him to lecture was one whose most prominent motto is *Audi alteram partem*. It may be that the shrewd men of the Society said to themselves, let the audience hear the other side, let them see it, let them realize its dogmatism, its imperiousness, its intolerance, its determination to ridicule every belief not its own, and then the cause of rationalism will appear to all the more advantage. We are not behind the scenes, and can only venture a conjecture, which after all may do the Society an injustice. But in any case we are certain of this, that the greatest benefit ever conferred on those who are forwarding modern metaphysics, was that which must result from the amusing, ridiculous, abusive, and irrational tirade which the Scotch Professor delivered on Sunday evening.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

MR. W. R. BIRT, who continues his valuable selenographical researches, has just sent us some observations to accompany "Lunar Map VIII." and which refer chiefly to the spots on Plato. A series of diagrams accompany the printed remarks, and contains several curves indicating the "degrees of visibility," of the spots. On glancing at the curves we see at once that they vary considerably amongst themselves, both in form and range; also that the increase and decrease are too irregular to warrant the reference of the phenomena presented by the spots to apparent changes produced by variations in the angle of incident light. The most efficient agent capable of affecting the visibility of such delicate objects is the earth's atmosphere, which we know to be continually varying in transparency; and without doubt those spots which have very low degrees of visibility are seen only when the earth's atmosphere is in its finest states. There are, however, features in the curves that cannot be explained by variations in the transparency of the earth's atmosphere, which must affect the same spots in the same way, and therefore occasion a similarity in the curves. These features are there described in detail.

THE *British Medical Journal* of Saturday contains an eloquent sketch of the life of Sir James Simpson, and publishes as a supplement an admirable engraving of the well-known Scotch professor. The *Journal* also furnishes the following interesting particulars in regard to the brain of the late baronet:—The weight of Sir James's brain, including the cerebellum, was 54 ounces. Whilst, as is well known, the ratio between intellect and size of brain is by no means close, yet there can be no doubt that it is very important. Most of our great men have had large crania. The male brain ranges chiefly between 46 and 53 ounces, its average being 49½ (Quain and Sharpey. That of Cuvier is stated to have weighed 64 ounces, and that of the late Dr. Abercrombie 63 ounces; but it is possible that some error may have crept in through the use of weights of differing standards. If not, Sir James's brain, whilst much above the average, did not nearly reach those of the celebrated men we have mentioned; but, at the same time, the convolutions were remarkably numerous. "They were," says a correspondent, "twisting and twining round on each other as if they could not find room within the head. The 'island of Reil' was very wonderful."

A FEW of the scientific societies are trying to carry out the plan, suggested by us some twelve months since, of uniting to erect a common building wherein to hold their meetings and

place their collections. It is a pity it should have taken so long to convince the societies of the usefulness of *our* scheme; but we trust that, now the matter has been taken up, as it was at the meeting of the Statistical Society the other day, some good will come of it. We told the societies, who expected much at the hands of the Chancellor of the Exchequer, that they would get nothing; and, lo! our prediction is fulfilled.

Mr. A. Ernst, our correspondent at Caracas, has just forwarded to us a Report of the Engineering College of Venezuela, dated March 23, 1870, from which we learn that our correspondent presented to the College a valuable set of meteorological records. These are comparative, and represent two separate observations made simultaneously, the one on the heights of Caracas and the other at the level of the sea. The readings of the barometers (Negretti & Zambra's) and the other instruments are given in detail; and from these it results that a correction has to be made in the estimate of the height of the cathedral of Caracas above the sea, M. Ernst's result being 920 mètres.

The number of the *American Entomologist* for April, now received, appears with an expansion of its title; it will henceforth be styled the *American Entomologist and Botanist*. The conductors very justly consider that Botany and Entomology should go hand in hand, and hence they have opened a new department in their columns. A series of entomo-botanical papers has been commenced in this number, and will be found of much interest.

The revenue returns for 1869 show that the catch of pearls and shell for the past year on the Gulf coast of the territory granted to the "Lower California Company" amounted to the large sum of $78,000. This, of course, is the valuation of the pearls given by the divers and speculators, and is consequently very much below the actual value of the catch. A pearl is sold frequently for $20, which, re-sold at Panama, at $200, brings $1,000 in Paris, and in many cases much greater profits have been made on very fine gems. Not one-half the catch is ever reported to the Government, and the yield of the Gulf for 1869 may be safely estimated at $300,000 in gold.

We learn from an American contemporary that the New York Historical Society proposes to establish in the Central Park a Museum of History, Antiquities, and Art. By an act of the legislature of the state of New York, the Central Park commissioners are authorised to set apart and appropriate to the Historical Society such portion of the grounds lying near the fifth avenue, between eighty-first and eighty-fourth streets, as may be required for the erection of suitable buildings for this museum. The plan contemplates the removal of the rich treasures of the society from the building in the second avenue, which has long been too small for their proper disposition and display, to a new and larger building in the Park, where, under proper restrictions, they shall be readily accessible to the public. In the department of history, the collections of manuscripts, maps, charts, newspapers, coins, and medals, will make a most conspicuous and interesting feature. In the department of antiquities the Abbott collection of Egyptian memorials, the Nineveh sculptures presented by Mr. James Lenox, and the numerous relics of the aborigines of the American continent, will attract great attention. These valuable curiosities have long remained packed in the society's present buildings, for want of space to open them for exhibition.

Professor Tyndall, like Professor Huxley, is nothing if not eloquent, but his oratory is of a bolder type. At the annual dinner of the Institution of Civil Engineers on the 4th, he made some remarks *apropos* of an allusion to his visit to the Alps, and they are so full of brilliancy of thought and noble feeling, that we quote them in full:—"My friend, Mr. Fowler," said Professor Tyndall, "has referred to my visit to the Alps. I have sometimes gone there, and have found the atmosphere in a peculiar state of opalescence, which disguised the mountains. This was not due to any opaque body scattered in the atmosphere, but entirely to the brilliancy of the atmosphere itself, which so bewildered the eye, that you could not see the bodies embraced by it. By such an atmosphere do I now find myself surrounded. I am lost in the golden haze generated within me by the eloquence which I have heard to-night. I have heard the admirable speech of the learned Solicitor-General. I have heard him describe the House of Commons; and after hearing that description, I fear I shall go home to my modest rooms discontented with those pursuits that have given me pleasure hitherto, and with a hunger and thirst to be a member of that house which contains and illustrates those high qualities. The name of science, sir, covers an area of intellectual action so large and so diverse that no one man is competent to answer for it; and, I suppose, the reason you have done me the honour of coupling my name with this toast is, that the pursuits of the engineer interlace, more or less, with those of the physical inquirer. The knowledge of nature and the progressive mastery over the powers of nature, imply the interaction of two things, namely, thought conceived and thought executed; the conceptions of the brain and the realization of those conceptions by the hand. The history of the human intellect hardly furnishes a more striking illustration of this interaction of thought and fact than that furnished by the association of physics and engineering. Take for instance the case of steam. Without knowing its properties, the thought of applying steam could not have arisen; hence the first step was physical examination. But that examination suggested practice, and the steam-engine at length saw the light; thus experimental physics was the seedling from which the steam-engine sprang. But the matter did not end here; the positions of debtor and creditor were soon reversed. For the stupendous operations of the steam-engine forced men of thoughtful, philosophic minds to inquire into the origin of the power of steam. Guess succeeded *guess*; inspiration succeeded inspiration. The ever-present facts of our railways, and our power-looms, and our steam-ships, gave the mind no rest until it had answered the question—how are heat and steam, its instruments, related to mechanical power? Had the work of the engineer not preceded the work of the natural philosopher, this question would never have been asked with the emphasis, nor pursued with the vigour, nor answered with the success which have attended it. It was the intellectual activity excited by the work which the civil engineers of England had accomplished that gave to philosophy the theory of the conservation of energy, including the dynamical theory of heat. Nor is the play of action and reaction between thought and practice likely to end here. For every gentleman *in this* great assembly, whose bent or vocation has led him to *reflect* on these things, well knows that the engineering genius of the future is certain to derive from this theory strength and guidance. Thus necessarily has thought originated fact, and fact originated thought. In the development of science these two powers are coequal; each in turn ceasing to be a consequence and becoming a creative cause. The Atlantic cable also had its small beginnings in the laboratory of the physical inquirer. Here, as before, experimental physics led the way to engineering feats of astounding magnitude and skill. But here, also, the positions of debtor and creditor have been reversed; for the work of the engineer has caused the physical inquirer to pursue his investigations with a thoroughness and vigour, and has given to those investigations a scope and magnitude which, without the practical stimulus, would have been impossible. The consequence is, that the practical realization of sending electric messages along the bottom of the Atlantic has been an immense augmentation of our knowledge regarding electricity itself. Thus, sir, does the human intelligence oscillate between sound theory and sound practice, gaining by every contact with each an accession of strength. These two things are the soul and body of science as far as you and I are connected with it. Sever sound theory from sound practice, and both die of

atrophy. The one becomes a ghost and the other becomes a corpse. Long, sir, may they continue united in a living and organic whole. Long may the powers of their brains and the cunning of their fingers enable the engineers of Britain to oppose to Nature the force of trained intelligence, and to cover the world with works conducive, not only to the bettering of man's physical condition, but to the elevation and purification of his intellectual and moral estate."

The poet laureate has signified to the council of the Astronomical Society his wish to accompany any expedition that may proceed to the south of Spain, to observe the Solar Eclipse of December 22nd next. We hope, perhaps we may expect, that he will "improve the occasion," and that "the Eclipse Idyll" will be one of the fruits of the expedition. There are many phenomena attendant upon a total eclipse that call for description beyond the powers of those accustomed to the dry chronicling of facts.

By the time this appears in type, Mr. W. S. Kent, F.R.M.S., will have started on his proposed dredging expedition in the Spanish waters.

Professor J. W. Plympton, Professor of Natural Philosophy, of the Cooper Union, U.S., was the recipient of a handsome testimonial of a silver pitcher and cup, from the members of his classes, on Monday evening, April 18th, after an appropriate address by Mr. J. Pearson, on behalf of the classes, to which the Professor responded in a happy manner.

The non-appearance of competitors for the Highland Society's agricultural diploma at the late annual occasion, when a staff of distinguished examiners in the science and practice of agriculture assembled for the determination of competency, proficiency, or excellence of agricultural students, has been followed by more disastrous experience on the part of the Royal Agricultural Society of England, whose examiners, having assembled to deal with only two competitors, were constrained to disqualify them both. What, asks the *Agricultural Gazette*, is the reason of this failure? Are there no agricultural schools among us? Are there no agricultural students in the country? Are none of them fit for an examination of the kind proposed? Is there no advantage derivable from success before the examiners? Are the conditions of the examination such as practically to forbid success? These questions seem to us to exhaust the subject. It is only some of them to which we can confidently give answers. There *are* schools and students of agriculture at both ends of the island; and we look for answers to our questions from them. Possibly some one, whether student or professor, North or South, may be able to explain the mystery to our satisfaction.

Dr. W. Goergs, the founder of the Universal Language Society, has already completed the grammar of his proposed language for facilitating the nomenclature of science and intercourse among nations. He is now actively engaged with his dictionary.

Mr. John Hampden is making an effort to get back his £500. He has sent us a printed document, signed by two *savans* as yet unknown to fame—Messrs. J. R. Gutteridge, of Brighton, and Alfred Bull, of Swindon—in which these gentlemen state that they have demonstrated that Mr. Wallace's demonstration of the earth's rotundity is absurd. When shall we hear the last of this foolishness?

The British Museum was open to the public up to eight p.m. for the first time on Monday week. The total number of men, women, and children who entered the Museum in the extra hours being six and eight was on the first day 75.

The last meeting of the Newcastle-on-Tyne Natural History Society was next made special, to consider the position of the Alder Memorial Fund. Mr. Brady stated that, since March, 1867, about £300 had been subscribed. Originally it was intended to raise £600 to carry out the memorial scheme. After some discussion it was agreed to make efforts to raise an additional £100, which was considered a sufficient sum to carry out the objects proposed. We trust our readers, who are familiar with Mr. Alder's valuable labours, will lend a hand in this matter. Mr. Alder was not merely a naturalist of local eminence, but one of European reputation.

Last Wednesday morning an interesting operation was per- at the Royal Albert Hall of Arts and Sciences, Kensington Gore. It will be remembered that the roof of this building is of unusual span and character, and that it has excited considerable interest in the engineering profession. It is of wrought iron, and covers an elliptical area of 220 ft. by 185 ft., with a rise of 33 ft. On striking the wedges between the crown of the roof and the massive scaffolding which had hitherto supported it, the result proved highly satisfactory, the total deflection on this immense span of 220 ft. being only five-sixteenths of an inch.

The Birmingham Rose Show for the current year will be held in the Town Hall on Thursday and Friday, July 7th and 8th. The Brighton Rose and Fruit Show will be held on June 28th.

Last week the Savilian Professor of Astronomy at Oxford, Rev. W. Pritchard, delivered his inaugural lecture at the New Museum, taking as his subject "The Modern Astronomical Discoveries." After referring to the distinguished ability of his predecessor, the learned professor proceeded to show the necessity there was for every one to have some acquaintance with this science. The several discoveries of astronomers within the last 150 years were alluded to, more especially those of Bradley and Herschel. The popular idea that this science was of no practical value was opposed, numerous examples of useful inventions arising from seemingly abstract investigations being instanced. The lecture was attended by the Vice-Chancellor and a large number of ladies and gentlemen, and occupied fully one hour.

Mr. J. S. Lawrie, writing to the *Times*, gives the following amusing anecdote in connection with the opposition received by the late Sir J. Simpson when introducing the use of chloroform in surgical and obstetric operations:—"Dr. Simpson, on first propounding the theory of the application of chloroform to patients requiring surgical aid, was stoutly opposed by certain Calvinistic objectors, who held that to check the sensation of pain in connection with 'visitations of God' was to contravene the decrees of an All-wise Creator. What was his answer? That the Creator, during the process of extracting the rib from Adam, must necessarily have adopted a somewhat corresponding artifice—'for did not God throw Adam into a deep sleep.' The pietists were satisfied, and the discoverer triumphed over ignoble and ignorant prejudice."

The Prince of Wales presided on Thursday at Marlborough House, at a meeting of Her Majesty's Commissioners for the Exhibition of 1851, held for the purpose of receiving the President and Vice-President of the Commission appointed by the Emperor of the French to co-operate in carrying out the International Exhibition of 1871. There were present at the meeting—M. Ozeme (the president) and M. du Sommerard (the vice-president), of the French Commission; Earl Granville, Mr. Gladstone, Sir Charles Lyell, Sir Roderick Murchison, Sir Francis Grant, Sir Francis Sandford, Mr. T. Baring, Mr. E. Bowring, Mr. T. Fairbairn, Mr. Gibson, Dr. Lyon Playfair, Mr. Thring, Mr. Vignolles, and Lieutenant-Colonel Scott (secretary). Mr. Cole attended the meeting.

The Commissioner of the General Land Office at Washington has received from Rockingham County, Va., specimens of crystallized Iceland spar. They possess unusual transparency. This mineral, when quite clear, has a high value, on account of its refracting qualities, which are such that it gives a double

image of anything seen through it, and it is used in the construction of polarizing instruments. Hitherto it has always been imported by American opticians. The extensive use made of it in sugar refining for testing by polarity the strength of saccharine solutions, and in the various scientific and manufacturing processes in which the Nicol's prism is employed, need not be detailed. The Virginia quarry is said to afford abundant yield of most excellent quality.

The delegates of the learned societies of France held their annual meeting at the Sorbonne a few days ago. As usual, the assembly was divided into three sections—science, archæology, and history. There were, says the Paris correspondent of the *Lancet*, but few medical contributions. M. Simonin, of Nancy, recorded the results of surgical operations performed during thirty-four years at the hospital of the town, and which showed the benefit of the employment of anæsthetics; M. Chassagny, of Lyons, stated the necessary means for facilitating vaccinal inoculation, the gathering of vaccine, and its proper preservation in tubes, &c., the means consisting in the use of a peculiar instrument, which, when once dipped into the lymph, may be employed for three or four punctures without any fresh provision of vaccine, and in the use of capillary tubes arranged in series of ten, and which may be closed by a mixture of starch and gum. MM. Feltz and Ritter, of Strasburg, communicated the results of several experiments connected with the action of the various principles of bile on the organism, and serving to elucidate the pathogeny of hæmorrhagic jaundice. Lastly, M. Chervin read a note on stuttering, in which he showed the easy cure of this infirmity.

Professor Challis has been elected a Fellow of Trinity College, Cambridge. This is the first election by that College under the Statute enabling them, by a vote of the Master and sixteen Fellows whose names stand first on the boards, to elect as Fellow a Professor of the University. Professor Challis has laboured long in the cause of Science. How faithfully and patiently he discharged the duties of Superintendent of the Observatory entrusted to him for many years by the University the published volumes of his observations amply testify, and Trinity College could not have bestowed its honours and emoluments upon one who had more fairly earned them.

The excavations that are being made in Bath for the construction of the new Pump Room Hotel have brought to light some very interesting Roman remains.

The names of candidates for the several special examinations at Cambridge in moral, natural and applied science, are to be sent in through the prælectors of their colleges on or before Monday, May 23.

Mr. T. T. Cooper, the enterprising traveller, who has been engaged for the last year or two, first from China and then from India, in exploring, as far as he found it possible, the Thibet route between India and China, has left Bombay for England, where the Geographical Society is desirous, with his assistance, to organize another expedition.

Mr. Busk has written to the *Athenæum* to state that the friends of the late Captain Brome, whose death was some time since announced in these pages, have commenced a subscription for the benefit of the late Captain's family. The case is one deserving the sympathy of all scientific men, and especially of palæontologists, and we trust that a goodly collection will be made. Subscriptions will be received by Mr. Busk, 32, Harley Street, W., and by Mr. W. S. Dallas, Geological Society, Somerset House.

The lovers of new and curious plants, says the *Gardeners' Chronicle*, may be glad to learn that they will find just now blooming in the Victoria Nurseries, Highgate, a specimen of the beautiful blue-flowered *Tillandsia Lindeniana*, as well as the noble *Cochliostema Jacobianum*, of which a full account, with a woodcut, was given in our volume for 1868, at pp. 264, 323. Both these plants are, we believe, flowering for the first time in England. The choice collections of stove and greenhouse plants, and of succulent plants, afford further inducements for a visit to Mr. Williams's establishment, while at this season the specimen azaleas and orchids alone suffice to furnish a rich floral treat.

We are given to understand that the late Mrs. Appold has left to the Institution of Civil Engineers a legacy of £1,000, payable at the same time as the legacy for a similar amount from her husband, the late Mr. J. G. Appold, F.R.S., Assoc. Inst., C.E. It is understood that both bequests are made for the general use and benefit of the society, without being fettered with conditions.

The use of the zircon or oxygen lights on the passenger car of the Broadway Pneumatic Underground Railway, in New York, has been discontinued, and common gas substituted. The gas is compressed in cylinders, and is made to pass through a soda-water bottle containing benzine; the brilliancy of the light is thus greatly improved, owing to the carbon which the gas takes up in passing through the liquid.

A colossal statue of the illustrious anatomist Morgagni is to be solemnly inaugurated at Forli, on the centenary of his death, December 7th, 1871. The statue has been modelled by the sculptor Salvini.

The Chair of Physiology in the University of Prague, vacant by the death of the celebrated Purkinje, has been filled by the appointment of Dr. Hering, of Vienna. It was offered to Professor Helmholtz, who, however, preferred to remain at Heidelberg.

The *British Medical Journal* says that the Scotch lady medical students are attending the Natural History course being delivered by Dr. Alleyne Nicholson, along with the male students. This the latter unanimously agreed to, when requested by Dr. Nicholson to give their opinion.

Professor Lamé, whose death was announced in our report of the French Academy last week, was a very celebrated physicist and mathematician, and was born in 1795, educated at the Ecole Polytechnique, and was for some time engineer in the Russian service. On his return to France he was appointed Professor of Physics at the above-named school, and remained in that capacity until the year 1845, when he was elected Examiner of the school. In the year 1848 he was appointed Professor of the Faculty of Sciences at Paris. Among his very many published works those on mathematics and on the elasticity of bodies are the most celebrated.

The Trustees of the British Museum have purchased from the executors of the late Mr. Toulmin Smith the best part of his large collection of fossils, including the unique series of the ventriculidæ of the chalk, gathered together and described by him.

Dr. Matthews Duncan will, it is rumoured, succeed to the professorial chair in the University of Edinburgh, vacant by the death of the late lamented Sir James Simpson.

Working of Plaster of Paris.—When two to four per cent. of finely pulverized althea root (marsh mallow) is mixed with plaster of Paris, it retards the hardening, which begins only after an hour's time. When dry, it may be filed, cut, or turned, and thus become of use in making domino-stones, dies, brooches, snuff-boxes, &c. Eight per cent. retards the hardening for a longer time, but increases the tenacity of the mass. The latter may be rolled out on window glass into thin sheets, which never crack in drying, may be easily detached from the glass, and take on a polish readily by rubbing them. This material, if incorporated with mineral or other paints, and properly kneaded, gives very fine imitations of marble, and can be coloured when dry, and can be made waterproof by polishing and varnishing. The chemist and chemical manufacturer will find it an excellent luting for vessels of every kind.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From May 1st to 14th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Diamond Snake (Morelia spilotes)	New South Wales .	Purchased	Reptile-house
1 Long-necked Chelodine (Chelodina longicollis) ...	River Yara, Austrl.	Ditto	Ditto
1 Black-necked Stork (Xenorhynchus Australis) ...	Malacca	On Approval	Eastern Aviary
2 Variable Lizards (Trapelus ruderatus)	Egypt	Presented by E. C. Taylor, Esq., E.Z.S..	Reptile-house.
6 Cuming's Octodons (Octodon Cumingi)		Born in the Menagerie	Small Mammal House
1 Bennett's Wallaby (Halmaturus Bennetti)		Ditto	Kangaroo-sheds
1 Sooty Monkey (Cercocebus fuliginosus) ♂	West Africa	Purchased	Monkey-house
1 Australian Thicknee (Œdicnemus grallarius) ...	Australia	Ditto	Western Aviary
4 Scarlet Ibises (Ibis rubra)	South America	Presented by A. Blumenthal, Esq.	Lawn-pond
2 Ditto	Ditto	Deposited by A. Blumenthal, Esq.	Ditto
2 White-throated Seed-eaters (Crithagra albogularis)	West Africa	Purchased	Parrot-house
1 Prince Alfred's Deer (Cervus Alfredi) ♂*	East Indies	Deposited by H.R.H. the Duke of Edinburgh, F.Z.S.	Deer-sheds
1 Fat-tailed Sheep (Ovis aries) (*var.*) ♂	Ditto	Ditto	Llama-house
1 Great Eagle Owl (Bubo maximus)	Ditto	Ditto	At back of Civet Cat's house
2 Sarus Cranes (Grus antigone)	Ditto	Ditto	Eastern Aviary
50 Young Salmon (Salmo salar)	British Waters ...	Presented by F. T. Buckland, Esq., F.Z.S.	Fish-house
50 Young Swiss Charr (Salmo umbla)	Lakes of Switzerld.	Ditto	Ditto
50 Young Swiss Lake Trout (Salmo lacustris)	Ditto	Ditto	Ditto
100 Young Common Trout (Salmo fario)	British Fresh Waters	Ditto	Ditto
10 American Trout (Salmo frontenalis)	North America	Ditto	Ditto
1 Greenland Seal (Phoca Greenlandica) ♂	Hudson's Bay	Purchased	Seal Pond
3 Bladder-nosed Seals (Cystophora cristata) 2♂ 1♀	Ditto	Ditto	Ditto
1 Yellow-footed Rock Kangaroo (Petrogale xanthopus) ♀		Born in the Menagerie	Kangaroo-sheds
5 Chestnut-breasted Finches (Donacola castaneothorax)	Queensland ...	Presented by the Acclimatization Society of Queensland	Parrot-house
4 Australian Quails (Synœcus Australis) 1♂ 3♂	Ditto	Ditto	Western Aviary
3 Laughing Kingfishers (Dacelo gigantea)	Ditto	Ditto	Ditto
2 Emus (Dromæus Novæ-Hollandiæ)	Ditto	Ditto	Emu-sheds
1 Stripe-thighed Wallaby Halmaturus) ♂*	Ditto	Ditto	Kangaroo-sheds
2 Verreaux's Guinea Fowls (Numida Verreauxi) ♂ & ♀	Eastern Africa	Purchased	Western Aviary
7 Pin-tailed Sand Grouse (Pterocles alchata) 2♂ 5♀	North Africa	Ditto	Ditto
1 Siamese Pheasant (Euplocamus prælatus) ♂	Siam	Ditto	Pheasantry
1 Canada Crane (Grus Canadensis)	North America	Ditto	Crane Paddocks
2 Bernier's Ibises (Ibis Bernieri)	Madagascar	Ditto	Eastern Aviary
1 Black-headed Conure (Conurus nandaya)	South America	Ditto	Parrot-house
1 Varying Conure (Conurus versicolor)	Ditto	Ditto	Ditto
2 Vinaceous Pigeons (Columba vinacea)	America	Ditto	Western Aviary
1 Javan Pea-Fowl (Pavo muticus) ♂	Burmah	Retd. from Acclimatization Soc. of Paris	Peafowl's Aviary
1 Red-throated Francolin (Francolinus rubicollis) .	Zanzibar	Presented by Dr. John Kirk, C.M.Z.S....	Western Aviary
2 Brown-headed Parrots (Pœocephalus fuscicapillus)	Ditto	Ditto	Parrot-house
3 Half-collared Doves (Turtur semitorquatus)	Ditto	Ditto	Western Aviary
2 Bronze-spotted Pigeons (Chalcopelia afra)	Ditto	Ditto	Ditto
6 Upland Geese (Chloëphaga magellanica)		Hatched in the Gardens	Geese-ponds
1 Redwing (Turdus iliacus)	Europe	Presented by F. Bond, Esq., F.Z.S.	Western Aviary
1 Black-backed Porphyrio (Porphyrio melanotus) .	Australia	Presented by A. Houlder, Esq.	Porphyrio's Inclosure
8 Dwarf Chamelions (Chamælion pumilus)	South Africa	Deposited by the Lady Cust	Reptile-house
2 Garganey Teal (Querquedula circia) 2 ♀	Europe	Purchased	Three Island Pond
1 Common Teal (Querquedula crecca) ♂	Ditto	Ditto	North Pond
4 Puddy-headed Geese (Chloëphaga rubidiceps) ...		Hatched in the Gardens	Goose-ponds
2 Cape Hyrax (Hyrax capensis)	South Africa	Purchased	Small Mammal House
2 Tuberculated Lizards (Iguana tuberculata)	Barbadoes	Presented by F. Graham Briggs, Esq. ...	Reptile-house
2 Graceful Ground Doves (Geopelia cuneata)	Australia	Purchased	Western Aviary
1 Painted Mud Tortoise (Emys arnata)	Nicaragua	Deposited by Mr. C. Gilman	Reptile-house
1 Mexican Box Tortoise (Cinosternon maculatum).	Ditto	Ditto	Ditto
1 Tropical Squirrel (Sciurus destuans)	South America	Ditto	Small Mammal House
1 Brown Capuchin Monkey (Cebus apella)	Ditto	Ditto	Monkey-house
1 Crab-eating Racoon (Procyon cancrivorus)	Ditto	Ditto	Raccoon's Cages
1 Guiana Partridge (Ortyx guianensis)	Ditto	Deposited by Mr. J. L. Symon	Western Aviary
1 Tree Boa (Corallus hortulanus)	West Indies	Ditto	Reptile-house
1 Grey Ichneumon (Herpestes griseus)	India	Presented by Mrs. Brown	Small Mammal House

♂ Male. ♀ Female. * Never previously exhibited. *** A portion of the above reached us too late for publication in our last.—[Ed. *S. O.*]

Existence of Tin in California.—At an exhibition of the agriculture, and manufacturing and mineral resources of California, held last year at San Francisco, sacks of ore, bars of tin-plate, of the heaviest quality, and utensils of every sort, for domestic use, which were manufactured from Californian ore, were there collected. Many doubted and shook their heads at this display of a long-desired but unusual manifestation of riches; but, since then, additional information and additional specimens of ore have been forwarded to the United States General Land Office at Washington, and an average sample of the same has been submitted for analysis to the able and distinguished chemist and mineralogist Dr. F. A. Genth, who reports that it contains 13·37 per cent. of tin. The black mineral in the ore is tourmaline (it contains boracic acid), and the brownish red is the cassitterite. It is a highly-interesting occurrence, and the yield of tin is almost twice as much as the usual working ores of the tin-mines of Cornwall, England. The property is said to consist of 50,000 acres of mining lands, and over twenty openings have been effected, from all of which the ore is extracted.—*Journal of the Franklin Institute.*

ON OZONE AND ANTOZONE.

BY R. H. ALLNATT, M.D.

IN TWO PARTS.—PART I.

THE specific forms of Ozone and Antozone which I have chosen for the subject-matter of our consideration this evening, are essentially the atmospherical products; and it may aid the elucidation of a very obscure and difficult problem, if, at the outset of our inquiry, we take a brief survey of the constituents of the atmosphere which surrounds our globe.

We live, you know, in the profundity of an atmospheric ocean of some 30, 40, or 50 miles in depth—it may be more; but observers are arrested almost at the very threshold of their inquiries by the impossibility of existing beyond a certain very moderate altitude.

A few years ago, you may remember, that Mr. Glaisher, Mr. Coxwell, and two or three other aspiring physicists, nearly lost their lives by trespassing too far upon the boundary of space. A few miles from the earth's surface the rarefaction of the air is so great as to produce death in a few minutes.

The chief constituents of this gaseous atmospheric envelope are oxygen and nitrogen, in definite quantities, mechanically mixed—*not* chemically blended. The least divergence from their normal proportions appears to be productive of a more or less pestilential medium, which engenders disordered action in the animal economy. The great aim of the pathological meteorologist is to bring a mass of facts to bear upon this important subject; and to elicit from the darkness that surrounds it, the dynamics of atmospherical combinations; or, in other words, to test the elemental aberrations, and deduce from them a rational theory of the origin of disease.

At the present moment, it is one of the most difficult things imaginable to attempt to determine what modifications shall constitute a healthy, what an unhealthy, atmosphere. Although pathologists are surrounded by tangible facts which lie on the surface, and recur moment by moment at every period of their lives, no theory has ever yet been attempted of these vital dynamics. We speak of the spread of zymotic disease and the propagation of morbific poisons by air-power, but, in reality, we know nothing whatever of the action of the elemental principle which has been educed by a combination that utterly escapes the grasp of our reason, and baffles the power of our apprehension. It reminds one of that mystery of mysteries—flint in chalk (a subject which was discussed by the members of this society a few meetings ago), which everybody can see, but the origin of which no one can comprehend. The object of the pathologist should be to form, from concurrent events, a series of observations, as little interrupted as the nature of the occupation will permit, that may exhibit in the record of physical facts some data whereon to found a rational theory of the influence of atmosphere in the production of human disease. And this has been, for the last five or six years, my own constant aim.

The question is frequently asked, What is ozone? Let me answer the inquiry by a brief summary of facts.

It probably gave rise to feelings of considerable surprise in the minds of most people when they learned for the first time that a molecule of ordinary atmospheric oxygen, which they had been taught to regard as a simple elementary substance, when breathed, and thus presented to the surface of the lungs, became split up into two oppositely electric atoms, and entered the circulation as ozone and antozone. It will be interesting to follow the process of reasoning which led to this inductive conclusion.

About the year 1838, M. Schönbein, Professor of Chemistry at Bâle—whose name became subsequently universally known in connection with the discovery of gun-cotton—in making experiments on the decomposition of water by the voltaic pile, was struck by the perfect analogy which existed between the peculiar smell that is evolved when ordinary electricity passes from the point of a conductor, and that which is disengaged when water is decomposed by a voltaic current.

All that time Schönbein supposed the odorous principle to be a simple elementary body, and he characterized it by the name of "ozone." The term does not convey any definite idea of its nature, but the designation has now become familiar by lengthened usage, and has been admitted, without cavil, into the nomenclature of science.

From certain indications which had been pointed out, Schönbein suspected that ozone existed naturally in the atmosphere. But this conjecture, or I should rather say, perhaps, the decided recognition of the principle, had been formed twelve years before, in or about 1826, by Dr. John Davy, brother of Sir Humphry Davy, and Van Marum, about the close of the last century, upwards of seventy years ago; the latter of whom had observed that oxygen, resting upon plain water, was not affected by electricity, except that it acquired a strong smell, that seemed evidently to be identical with that produced by the matter of electricity. Dr. John Davy had pointed out not only the minute facts attending the production of atmospheric ozone, but, in his *Lectures on Agricultural Chemistry*, suggested the precise formula of the chemical tests, which was subsequently adopted by Schönbein.

The fact of this novel condition of oxygen, when first publicly announced, created no small stir in the scientific world, and it was predicted that, as the handmaid of science and the arts, the new agent would confer important benefits on mankind. To the medical man and the pathologist its action was deemed of paramount importance, for it was found that the air in its normal condition contained one ten-thousandth part of ozone, and that in one two-thousandth part it occasioned death by asphyxia.

Ozone is produced in the atmosphere by a variety of causes, and, according to M. Scoutetten, who first published a work on the subject, it is not a mere chemical agent, but is an instrument in the hands of the Creator of the universe for the production of the grandest phenomena of nature. By it, he says, can be explained the laws of atmospheric electricity, the formation of aqueous meteors, the periodical and diurnal oscillations of the barometer, and the means of restoring to the atmosphere the oxygen contaminated by respiration, by natural oxidation, and by combustion.

The fact did not escape our author that ozone is invariably absent from close, ill-ventilated dwellings. Slips of ozonoscopic paper were kept in the wards of the military hospital at Metz—of which he was chief physician—several days, without affording the slightest trace of discoloration, whilst the tests exposed to the full influence of the external atmosphere gave 7° to 10° of the ozonometric scale. Other experiments, prosecuted by Dr. Berigny, at Versailles, were attended with identical results. Several others, made in this country, also satisfactorily prove that, beyond the quantity of ozone which enters a dwelling-house with the external atmosphere, no further manifestation of increase occurs. And it cannot be wondered at when we consider that ozone, being the product of elementary commotion, such as that produced by thunderstorms, conflicting wind-currents, and such-like natural phenomena, can never be engendered in a quiescent or stagnant air. M. Scoutetten winds up this part of his report by stating that it is impossible, therefore, to avoid the conclusion that a clue is thus given to the different effects produced upon the health by in-door exercise and out-door exercise, by town life and by country life, by labour in the crowded workshop and labour in the open fields. We shall see, by-and-by, that this estimate of facts is considerably exaggerated.

In the year 1851, at a meeting of the members of the Royal Institution of Great Britain, Professor Faraday gave a brief summary of the then existing state of the question on this interesting subject. He reviewed the ancient facts which belong to it, and the high hopes of progress which it offers for the future. He stated the sources of ozone to be—when the

electrical brush passes from a moist wooden point into the atmosphere, and, indeed, in almost every case of electrical discharge in the air; or when water is electrolyzed, as in the case of a dilute solution of sulphuric acid or sulphate of zinc; or when phosphorus acts at common temperatures on a moist portion of the atmosphere.

Ozone, when obtained by these three essentially different processes, is identical in every respect; its properties are as follows:—1. It is a gaseous body of a very penetrating nauseous odour; when concentrated the odour approaches that of chlorine; when diluted, it cannot be distinguished from what is called the electric smell. 2. Common atmospheric air strongly charged with it renders respiration difficult, causes unpleasant sensations, and by its powerful action on the air-passages produces catarrhal effects. Such air speedily kills small animals plunged in it, so that in its pure state ozone is highly deleterious to the animal economy. 3. It is insoluble in water. 4. Like chlorine, bromine, and the metallic peroxides, it is a powerful electromotive substance. 5. It discharges vegetable colours with a chlorine-like energy. 6. It converts phosphorus into phosphoric acid. 7. At common, and even low, temperatures, it acts powerfully upon most metallic bodies, producing the highest degree of oxidation of which they are capable. 8. It transforms many of the lower oxides into peroxides. 9. It decomposes rapidly the proto-salts of manganese, the solution of the tribasic acetate of lead, and rapidly converts the proto-salts of iron and tin into persalts. It destroys many hydrogenated gaseous compounds and compounds of hydrogen. By its continued action iodide of potassium becomes converted into iodate of potassa, and it produces oxidizing effects upon most organic compounds, causing a variety of chemical changes; thus guaiacum is turned blue by it.

From the above wide range of enumeration (which I have considerably curtailed to avoid tedious recapitulation) it would appear that ozone is a most ready and powerful oxidizer, and that it is oxygen in an allotropic state—that is, with the capability of immediate and ready action impressed upon it. We also learn the important effects which must arise from the universal and never-ceasing agency of this all-pervading elemental principle.

In 1859, at another meeting of the members of the Royal Institution, the late lamented Prince Consort in the chair, Dr. Faraday again adverted to the subject of ozone, and stated that Schönbein had been lately led to the belief that oxygen can exist in a *third* state, as far removed by its properties from ordinary oxygen in the one direction as ozone is in the other, and therefore, in a certain sense, *antagonistic* to ozone. This substance he names "Antozone," and believes that it also enters into combination, retaining for a time its special properties. Hence there are not merely ozone and antozone, but also ozonnide and antozonide compounds. Thus permanganic acid, chloric acid, peroxides of manganese, lead, cobalt, nickel, bismuth, and silver form a list of bodies containing more or less of ozone in combination; and the characters of ozone, and of these bodies, because of the ozone in them, is, that they are electro-negative to the antozonides. On the other hand, oxywater and the peroxides of potassium, sodium, barium, strontium, and calcium form a list of substances containing antozone.

These bodies are electro-positive to the former; they cannot evolve chlorine from hydrochloric acid or the chlorides, and they not only do not render blue the white precipitated guaiacum; but they restore that which has been rendered *blue by ozone to its white or colourless condition.*

Thus, according to the testimony of that most accurate observer, Faraday, stood the question in 1869, but in 1865 a paragraph went the round of the English scientific journals, uncontradicted, announcing in precise and positive terms that Schönbein had succeeded in isolating antozone. In a report of mine to the *Times* in September of that year I restated the fact in the following terms:

"Schönbein has succeeded in isolating antozone, one of the bodies of which ordinary oxygen is composed. It has, he says, a density less than that of hydrogen, and is, therefore, the lightest body known. It liquefies at a pressure of 150 atmospheres. Ozone and antozone combine with explosion in the dark rays of the spectrum, and ordinary oxygen is reconstituted."

This provoked a somewhat unguarded reply from Professor Roscoe in the next issue of the *Times*, in which he says:—

"In your impression of yesterday I find a letter from Mr. R. H. Allnatt, concerning a supposed decomposition of oxygen said to have been made by Schönbein. In order that the public may not be misled by random reports of scientific facts, I write to say that, having been present at the recent meeting of the Swiss scientific men at Geneva, I spoke to Professor Schönbein respecting this reported discovery. 'He was much amused by the inventive powers of our countrymen in concocting a story for which there is *not the slightest foundation.*'

"It behoves Mr. Allnatt to assure himself of the accuracy of his scientific facts before he gives them a world-wide circulation in your columns. "Your obedient servant,

"Henry E. Roscoe, F.R.S."

But this positive asseveration of Professor Roscoe was not without its antidote, for I was enabled in the following March, 1866, to publish this rejoinder in the *Times*:—

"*The Truth about Antozone.*

"Will you favour me by publishing the following extract from an important communication recently received from Professor Schönbein? It will set at rest the controversy raised by some persons in this country, who in utter contravention of facts, have denied the very existence of antozone.

"M. Schönbein's letter was addressed to Dr. Fredk. D'Alquen, a gentleman well versed in German literature, who having forwarded to Schonbein an account of the various rumours which recently appeared in this country, the Professor replied as follows:—

"'I certainly accept two antagonistic modifications of oxygen, viz., ozone and antozone, and believe also to have succeeded in isolating both, not recently, but years ago. However, what I never asserted, and could not assert, is, that I have obtained ozone or antozone in a pure state, as up to this day I have not been able to obtain either the one or the other, otherwise than with an admixture of ordinary oxygen.

"'For this reason it was not possible for me to determine their physical properties, as specific gravity, &c. But, as it has been stated that these, and other wonderful properties, have been discovered by me, my reported denial, given privately, on being questioned, had only reference to those idle and unfounded statements, but by no means to the existence of antozone in an isolated state, of which I am as certain as of the existence of ordinary oxygen.'"

In 1861 Schönbein had written to Faraday (and the letter appeared in the *Philosophical Magazine* of that year), "I have been working hard, these many months, to obtain antozone; and I flatter myself I have succeeded."

My original communication, therefore, involved no great stretch of "credulity" to credit Schönbein in 1865 with what he avowed he had accomplished in 1861.—*Paper Read before the Eastbourne Natural History Society.*

ON IRONCLAD SHIPS.

BY E. J. REED, ESQ., C.B.

Chief Constructor of the Navy.

In Two Parts.—Part I.

ONLY eighty-three years ago the first iron vessel of which we have any record—a canal boat—was built; it is but fifty years since the first iron *ship*, which was also a *steamship*, was constructed; and but thirty years since iron sea-going ships came into extensive

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use. Only sixteen years ago the first armour-clad vessels—floating batteries—were built for service during the Crimean war; and it is but twelve years ago that the first ironclad *ship*, *La Gloire*, was commenced. Now, every ocean is traversed and every important port visited by iron vessels; the largest and finest merchant ships afloat are built of iron; a very large proportion of our mercantile marine is constructed of that material; and the three great naval Powers—England, France, and America—possess together over a hundred and fifty ironclad ships of all classes, while Russia, Prussia, Austria, Italy, and other Powers probably have altogether as many more.

When the question of protecting ships against shot and shell first came to be discussed, there was naturally great diversity of opinion as to the best means to be employed. All classes of the public—including numerous clergymen—put forward schemes for the purpose, many of which were extremely singular. Iron armour was mostly in favour, but the methods proposed for its application were very various. "Arched," "angulated," "corrugated," "fluted," "articulated," and "hollowed" armour plating, faced and backed with all kinds of materials—such as wood, steel, sand, hides, india-rubber, wool, cotton, cocoa-nut fibre, cork, spiral springs, &c., &c.—was strongly recommended by one class of inventors. Another class preferred some other protecting materials—wood, vulcanised india-rubber, cotton, &c.—instead of iron, and put forward schemes for using them. Others devoted attention to, what they thought, improved plans of fastening armour to the sides; and one inventor—a Frenchman—went so far as to propose to protect ships by movable plates, carried along on rails, and fixed temporarily where the attack of an enemy had to be resisted, "a sharp look-out being kept on the enemy's guns, to discover the point at which the plates would be required.

The simple plan of bolting slabs of iron to the sides of ships found favour with professional shipbuilders from the first, and has continued in use ever since. The question to which they devoted most attention was, What kind of ship would be best adapted to carrying armour? The floating batteries first built were not ship-shape in form or equipment, and were specially intended for attacking forts. *La Gloire* was the first armoured sea-going *ship*. She was comparatively short and full, her ports were not high above water, and her rig was very light. Her construction was undoubtedly due to the proposals which the Emperor of the French had previously made to convert line-of-battle ships into ironclad block-ships; and she proved moderately efficient in her sea-going capabilities, although the whole of her exposed broadside was covered with armour.

Our first ironclad, the *Warrior*, was designed on entirely different principles. She was made extremely long and fine; only a little more than half the exposed broadside was armoured, the extremities being quite unprotected; her ports were high out of water; and her rig was much heavier than *La Gloire's*. so that she was capable of proceeding under sail alone. Her safety, therefore, depended largely upon the water-tight subdivision of the hold space at the extremities; and on this account many persons preferred *La Gloire's* "complete" protection to the *Warrior's* "partial" protection. In fact, after one or two modifications of the *Warrior* plan, our designers actually adopted the system of complete protection in the converted ships of the *Caledonia* class, and in the large ships of the *Minotaur* class. In the latter, all the other main features of the *Warrior's* design were retained, and the strength of the armoured side was made about equal to the *Warrior's;* but to do this a length of 400 feet, and a burden of more than 6,600 tons were considered necessary. These were the last of the so-called "long" ironclads built, and we are not likely to build any more; if we had kept on in the same course we should by this time have been building ironclad *Great Easterns*, costing a million or a million and a half each, to carry the thickness of armour some of our recent ships bear on their sides.

The contrast between these early vessels and our recent ironclads, built during the last seven years, is very great. The *Warrior*, for example, carries only 4½-in. armour on a burden of 6,100 tons, while the *Bellerophon* carries 6-in armour on 4,270 tons. The *Minotaur*, with a burden of more than 6,600 tons, carries 5½-in. armour; the *Hercules*, of about 5,200 tons, has 9, 8, and 6-in. plating, in addition to special arrangements of backing at the water-line belt. Our latest vessels, the *Thunderer* class of monitors, compare still more favourably with the *Minotaur*, as they carry 12-in. armour on a burden of 4,400 tons, and are impenetrable by the heaviest guns afloat. This superiority in the recent ships is due to various changes, that will be referred to almost immediately; and the incentive to these rapid advances in thickness of armour is to be found in the increased weight and power of naval guns. In 1859 the 68-pounder cast-iron gun, weighing 4¾ tons, was our most powerful weapon: at present we have 600-pounder 25-ton guns, besides 18-ton, 12-ton, 9-ton, and 6½-ton guns. The lightest of these is more powerful than the 68-pounder, and could pierce the *Warrior's* side at 500 yards, while the old gun could not at 200 yards; and our 25-ton gun would probably pierce most ironclads at a range of two miles. Heavier guns are talked of, and will probably be made soon; 30-ton guns are actually ordered; but so far as we are able to judge, our present guns are superior to any possessed by the French and Americans, and in strength of armour we certainly have a long lead. In fact, our iron-clad fleet now compares very favourably with the fleets of other nations.

The remarkable progress made in our ironclad construction during the last seven years is mainly due to three causes:—Changes in forms and proportions; altered arrangements of armour; and structural changes. Recent ships are shorter and fuller than the *Warrior* and *Minotaur*, but they are quite as fast, or faster, notwithstanding. Our two fastest ironclads, the *Monarch* and *Hercules*, are, in fact, examples of the short type. This question of speed was much debated at first; but, *if* experience can settle it, no further debate will take place. The reduction in dimensions in recent vessels has also given them wonderful handiness under steam as compared with their predecessors, and this has been still further increased by adopting the balanced or differential rudder. For example, on the official trials, the *Minotaur* took 7′ 38″ to traverse a circle 939 yards in diameter; while the *Hercules* turned completely round in 4′ and traversed a circle only 562 yards in diameter.—*Lecture delivered before the Royal Institution.*

NOTES ON THE CULTIVATION OF THE CHINESE PRIMROSE.

BY J. JAMES,

Head Gardener, Redlees, Isleworth, W.

THE value of the Chinese Primrose for conservatory decoration during the winter and early spring months, is now so well known that it is utterly unnecessary to say a single word in its favour; therefore, instead of occupying space with eulogizing its merits, we will pass on at once to the consideration of the cultural details.

Within the last three or four years the Chinese primrose has undoubtedly undergone considerable improvement; and in both the single and double varieties we have several distinct hues of colour. I shall confine my remarks exclusively to the single varieties, as the double-flowered varieties require more skill in their management than the great body of amateurs possess. The latter are undoubtedly invaluable for furnishing a supply of cut flowers during the winter, but they lack the showiness of those varieties with single flowers, and therefore, for ordinary decorative purposes, are inferior to them. A strain of primulas, with a few twisted petals in the centre of each

flower, has started into existence within the last two or three years, but they are simply an abomination, and should not be tolerated anywhere. The only point that has hitherto been urged in their favour is their adaptability for bouquet making, but as yet I have failed to discover the advantages they possess over those with flowers of the ordinary type. The *Fern-leaved* varieties are interesting, as also are the *Anemone-leaved*, but, in my estimation, those with leaves of the ordinary form are preferable. The *Striped* varieties are not, in my estimation, sufficiently distinct in character to be worth growing extensively, if, indeed, they are worth growing at all. The spots and stripes are not bright enough, and, at a distance of a few feet from the eye, they are indefinable, and give the flowers a somewhat dirty appearance. There is yet another strain of primulas that must not be passed over without a word. I allude to the white-flowered varieties, with brown flower-stems and leaf-stalks. It would be rash, perhaps, to condemn this strain as worthless, but it will be speaking within the mark to say that it is in every way inferior to the white varieties, with white flower-stems and leaf-stalks. The only sorts grown here are the ordinary white and crimson single varieties; and as it is necessary to expend just as much time and labour on the production of plants with inferior flowers as it is on those with good ones, we save our own seed, and so make sure of what we grow. There is, however, an abundance of good seed in the trade, and those who have not a good strain of flowers from which to save seed, will do well to begin afresh with seed obtained from a respectable house. Before dismissing this part of the subject, it will, perhaps, be as well to observe that high-bred, perfectly finished flowers produce very little seed indeed; and to sell a packet of seed saved from them for a shilling is simply impossible, without loss to the vendor.

To insure a continuous display of primulas throughout the winter, make two sowings of seed; the first sowing the last week in May or the first week in June, and the second towards the end of August. The first batch of plants will commence flowering in November, and the second early in January, unless the first flower-buds are nipped out, and in that case the time of their coming into flower will be delayed for a month or six weeks. Sow the seed in five-inch pots, previously prepared by draining them efficiently, and then filling them with a light rich compost. Make the surface of the soil perfectly level, to prevent the possibility of any portion of the seed being buried too deep. Also water the soil moderately, previous to sowing the seed, to prevent the necessity of a heavy application of water after the seed is sown. The seed should be covered as lightly as possible with fine sandy soil, and the pots then placed in a pit or house, the temperature of which is maintained at about 60°. It is also important to sow the seed rather thinly, to prevent overcrowding before the young plants are strong enough to prick off.

Instead of potting the plants off separately in small pots, when they are removed from the seed-pot, as practised by some growers, they should be pricked off into seed-pans, as it suits them much better. It is desirable to place the seed-pans in the temperature advised above, until their occupants are nicely established in their new quarters. This takes up about a fortnight, and at the end of that time remove them to a cold frame, which will be the most suitable quarter for the plants until the autumn.

When strong and well established, pot off singly into 3 in. pots, and stand them upon a bed of coal-ashes in a cold frame. After the pots are well filled with roots, but before the plants have become potbound, shift them into 5 in. pots, and as soon as they are well established in these, shift again—the strongest plants into 8 in. pots, and the others into pots one size larger, and that will be the last shift they will require.

The most suitable compost in which to grow these plants is one prepared by well incorporating together three parts turfy loam, and a fourth part consisting of equal quantities of decayed cow-dung and leaf-mould. To this add a liberal sprinkling of sand, and if the loam is deficient in fibre, or the leaf-mould is not available, a small proportion of cocoanut-fibre refuse may be added, to assist in keeping the mass open. It is scarcely necessary to say that the pots must be effectually drained to prevent the soil becoming sour, through the inability of the water to escape quickly.

After the plants have recovered from the effects of their removal from the seed-pan to the small pots, ventilate freely both night and day throughout the season, and until danger from frost may be apprehended, and then remove them to a cool, moderately airy house. The plants should be shaded from the direct rays of the sun during the months of June, July, and August. A mat thrown over the glass during the middle of the day when the sun is shining brightly, is all that is necessary in the form of shade.

Water carefully at all seasons, but more especially during the winter months. The plants must, of course, have sufficient moisture, but the soil must not be maintained in a constant saturation. The best system of watering is to give sufficient to moisten every particle of soil within the pot, and then give no more until the soil has become somewhat dry again. Avoid the use of stimulants, and use soft water only. Liberal supplies of liquid manure are advised by some growers, but I am convinced that the subjects under consideration are as well, if not considerably better, without manure water.

The whole stock should have a temperature of about 45° or 50° throughout the winter, as the plants from the second sowing will grow freely during that season. To produce large specimens, and also to prolong the season of flowering over as lengthened a period as possible, nip out the first flower-buds of the strongest plants of the second batch immediately they are sufficiently advanced.

One word in conclusion. Do not attempt to keep plants a second season, no matter how promising they may appear. They invariably rot off just above the soil at the commencement of the following season, and even if they do remain in health, the flowers are always small in size and poor in colour, compared with young plants. There is no gain whatever, as regards size, in preserving the old plants after they have done flowering, because specimens can be grown equally as large from seed sown in the spring of the same year, if managed as advised in the foregoing directions.—*The Floral World*, May.

FOG SIGNALS.

IN some places there is a curious natural provision for fog-warning, in the fact that the spots in question, generally islands, are the habitation of large numbers of sea-birds, which make a noise that can be heard far away. The South Stack, near Holyhead, is a well-known example; and in these places the birds are generally preserved and fostered as benefactors to mankind. But such cases are rare, and artificial expedients have to be resorted to. Bells have been tried—we all know the story of the Inchcape Bell, and have heard of the Bell Rock on the Scotch coast; and every yachtsman has passed the Bell Buoy at the entrance of Southampton Water—but the sound of both bells and gongs has been found to be so damped by fog as to be heard only a short distance away. Guns are troublesome, and not always suitable; and there has been, until lately, much difficulty in finding anything that would do. A short time ago, however, an invention by an American, Mr. Daboll, was brought to the notice of the Trinity House authorities; and, as it appeared promising, it was tried with so good a result that it may probably come more extensively into use as a fog-signal. We have been allowed, by the courtesy of the authorities, an inspection of the apparatus, and will endeavour to explain its construction and action to our readers. It is a very powerful horn or trumpet, blown by highly-compressed air, the sound being produced

however, not on the principle of either of these instruments, as ordinarily used in military bands, but on that of the clarionet or the brilliant trumpet-pipes of an organ. The sound of a clarionet is due to the vibration of what is called a *reed—i.e.* a thin tongue of elastic material, which is placed so as to cover a long opening or slit leading into the pipe of the instrument. The reed is fixed at one end, the part over the opening being left free to vibrate. When the player covers the reed with his mouth and attempts to blow into the tube, the reed, by its flexibility and elasticity, alternately closes the opening and leaves it again, allowing a jet of air to enter the tube every time the opening is free. By this action the reed is set into quick vibration; and the puffs of entering air, following each other in regular succession and with great rapidity, give rise, on well-known acoustical principles, to a musical tone. This tone is further modified in quality by reverberation in the tube of the instrument, and is greatly strengthened by the bell-shape given to its extremity. The pipes of what are called the *reed-stops* of an organ are on the same principle as the clarionet; but the vibrating reed is in this case a thin plate of brass, varying in size according to the pitch of the note; but, for the middle tones, an inch or two long, a quarter to half an inch wide, and the substance of a thin card. The mouth of the player is represented by a box, inclosing the whole of the reed apparatus, and the pipe is generally of metal, conical in shape, or with a bell-mouth some inches in diameter. The fog-horn is essentially of the same construction as the reed-pipe of an organ, but with all its parts magnified to colossal dimensions. The reed, instead of being a thin leaf of brass, is a thick plate of hard steel, five inches long, two inches wide, and a quarter of an inch thick at the root, tapering down to an eighth of an inch at the loose end. The tube is of brass, eight or ten feet long, gradually expanding in diameter till it finishes in a bell-mouth two feet across. The pipe is placed vertically, its upper part projecting through the roof of the building, and being bent into an elbow, so as to make the bell part horizontal, delivering its sound straight out to sea. The compressed air for sounding the horn is supplied from a reservoir, into which it is forced by pumps worked with mechanical power. In the experimental apparatus a hot-air engine, of American contrivance, is used for the purpose; but a small steam-engine would probably be a more simple and trustworthy machine. A duplicate engine is required in case of any part getting out of order. The pressure of air required to sound the pipe is on the same magnified scale as the pipe itself; in an organ it amounts only to an ounce or two on every square inch; for a fog-horn it is from five to ten pounds, and the quantity of air required at this pressure is very large. It is difficult to believe that any force of mere air would be sufficient to set in vibration the huge blade of steel, as strong and as stiff as a large carpenter's chisel, forming the reed, but there is no doubt of the fact.—*Cornhill Magazine.*

ATMOSPHERIC ELECTRICITY AND RECENT PHENOMENA OF REFRACTION.

BY SAMUEL BARBER.

WHATEVER connection may exist between earthquakes and electrical disturbance of the atmosphere—a connection remarkably substantiated during the past year—there seems little reason to doubt that there exists between the electric waves or currents and the condition of atmospheric vapour a close relation. The more we examine the various changes of cloud and mist, their multiform shapes and ever-varying tints, their changes in density, altitude, and attractive or repulsive power, the more are we convinced that a force of incalculable power and undefined extent, more subtle and scarcely less potent than that of gravitation, is in constant operation upon them.

The operation to which I allude, that of electricity, both atmospheric and terrestrial, seems rather to have been studied in its exceptional manifestations, than as a force subject to law, and of vast and constant, though unobtrusive, influence. The difficulty of rendering this science deductive, in its relation to meteorology, is apparent; the collection of data and the progress of experimental research form our present basis.

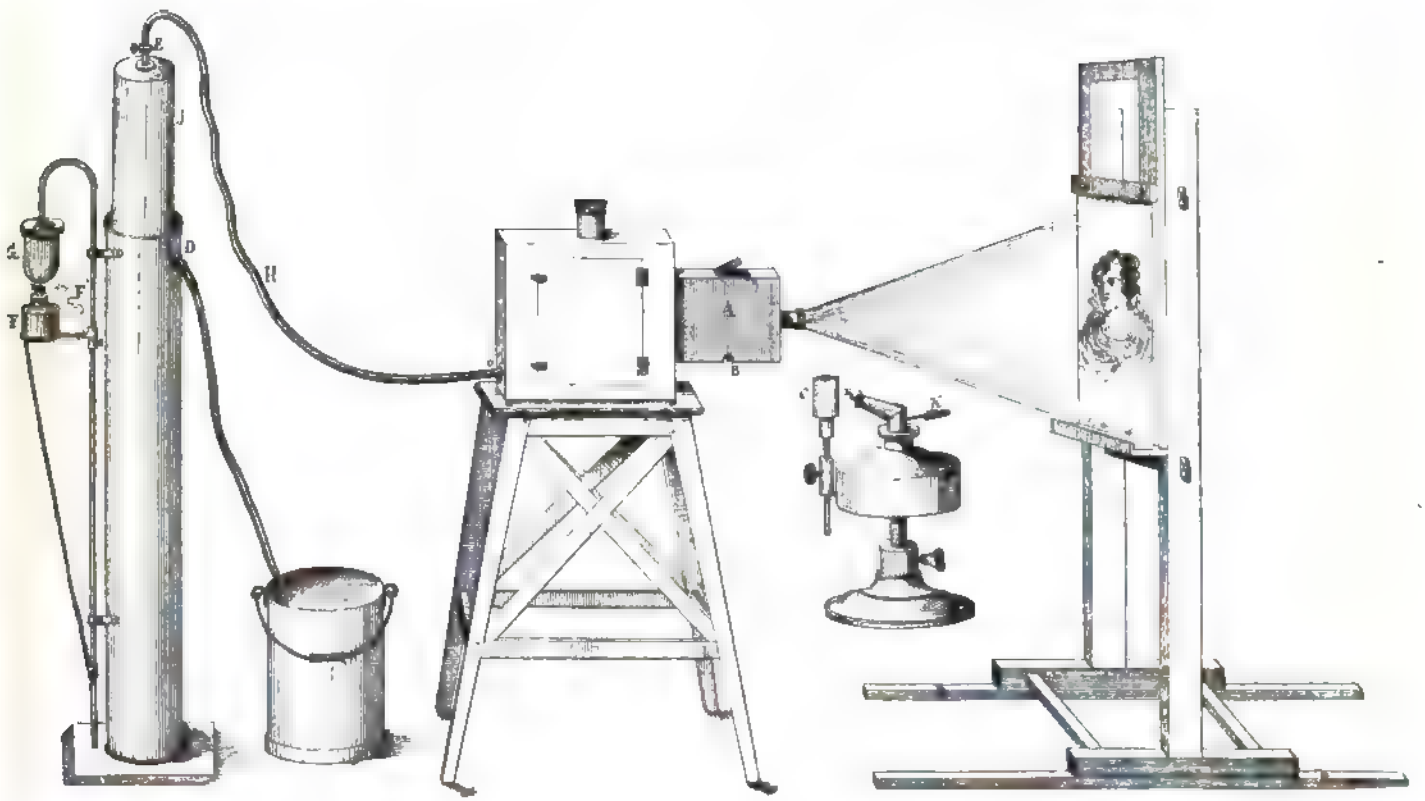
Till something more is known, however, and known more definitely, as to the nature of cloud and fog constituents, we can scarcely expect much progress in this department; and I would commend the subject to aëronauts and microscopists. Mr. Proctor, in an interesting paper on the subject of rain,[1] quotes De Saussure, Kamptz, &c., against Sir J. Herschel and Tyndall, appearing to incline to the views of the latter writers. He does not, however, allude to electrical action in enumerating the causes of rain. Yet it seems to me there is no reason to believe that the aggregation or dissociation of clouds and the condensation of their particles is greatly due to the influence of this force. That the movements of cloud and mist are accompanied by strong electrical action has been shown by the experiments of Mr. Crosse, of Bromfield, and Mr. Ronalds;[2] and it is but reasonable to think that this action may have great influence on continuous vapour, though unaccompanied by a disruptive discharge, or any luminous appearance. My observations induce me to think that electricity is also indirectly the cause of those peculiarities of refraction which depend upon the molecular condition of the vapour mediæ through which the light passes, viz.—Halos, Parhelia, Paraselenæ, &c.; and I may here remark that these phenomena appear to have been unusually abundant during the past year, which has also afforded such exceptional displays of aurora, &c.

On the 21st September, a halo, of large diameter, say 60°, corresponded in position with the cirrhus clouds which formed the refracting medium. This halo followed the irregularities of the cloud to a considerable extent. Its disappearance was almost instantaneous, being caused apparently by the approach of a large mass of cumulus in the lower region of the sky. Almost as soon as the latter touched the lower part of the circle, the halo vanished. The irregularities in the circle of light at one time took the form of a series of separate arcs, which bent inwards, and appeared to be composed of half-dissolved cirrhus. These irregularities of form were also very conspicuous in a remarkable halo, which was seen on Friday evening, December 19th. This assumed a spheroidal form, and was intersected by streaks of cirrhus, which changed their form rapidly, and showed a prismatic refraction like that of the halo itself. The vanishing of the first-mentioned halo was perhaps caused by an alteration in the constitution of its crystals or vesicles, resulting from the electric action of the cloud below.

The next appearance I have to describe was of a singularly beautiful form and perfect definition. It appeared imbedded in a mass of homogeneous vapour, and consisted of two distinct rings, the inner one of a deep cobalt blue. This ring was distant from the moon's disc about three diameters. Its outline was clearly defined, especially towards the inner part of the circle, and the colour was exquisite in tone. Farther from the moon, by about two apparent diameters, there was another ring, less defined and wider than the first, and of a beautiful crimson colour. Altogether this was the most beautiful appearance of the kind that I ever witnessed. It occurred about 11½ P.M. on the evening following that on which the first-described halo appeared. All three were followed by drenching rain, lasting about a week in the first case. A gale came shortly after the second (December 19th). The cirrhus clouds, which almost filled the sky, resembled in form an appearance of aurora on this occasion, and had a peculiar motion, vanishing and reappearing in fresh forms, though there was no wind at the time.—*Quarterly Journal of Science.*

[1] *Intellectual Observer*, December, 1867.

[2] *Vide* Sir S. Harris's *Electricity*.



M. ROMAIN TALBOT'S NEW PHOTOGRAPHIC ENLARGING APPARATUS.*

TALBOT'S APLANATIC APPARATUS FOR PHOTOGRAPHIC ENLARGEMENTS.

BY R. J. FOWLER.

THE above represents the chief portions of the apparatus introduced recently by M. Romain Talbot, and they scarcely need further description. It will be observed that the lamp for burning spirits of wine, through the flame of which the oxygen is sent by the tube K on to the piece of magnesia, &c., C, differs little from an ordinary spirit-lamp, and much from those generally used in England for this purpose. The oxygen is produced in the metallic retort G, which is heated by the spirit-lamp F, and is received into the metallic reservoir E J D. The weight of the upper vessel J is said to give sufficient pressure to the gas. The advantages claimed for this gasometer over the gas-bags are, that it is always ready; it does not require the use and trouble of pressure-boards; it cannot well get out of order, and if it does any tinman can repair it—advantages to be appreciated by those who live at a distance from—I was going to say, all but tinmen—but from skilled workmen. Another advantage of the gasometer is, that the light is more fixed than with gas-bags. I have my doubts whether sufficient pressure can be obtained by this means; but I am assured there is no fear of this. The lamp is constructed so that it can be used with common gas instead of spirits of wine, if required.—*British Journal of Photography.*

The Pharmaceutical Society.—This society will hold a *conversazione* in the South Kensington Museum this evening, the 18th.

* Block courteously lent by the Editor of *British Journal of Photography.*

REVIEWS OF BOOKS.

Preliminary Field Report of the United States' Geological Survey of Colorado and New Mexico. By F. V. HAYDEN, United States Geologist.

IN our former notice of this work we promised on a future occasion to deal with it at more length. We now redeem our pledge:—

The Colorado is an interesting country to the geologist from its containing a great variety of formations, and this report describes only a limited portion, although of considerable extent, examined by the survey under the direction of Mr. Hayden during the preceding year (1869). The rocks comprise igneous and metamorphic, including the Laurentian gneiss, succeeded by Silurian, Carboniferous, Permian (?), Triassic, Jurassic, Cretaceous, and lower, middle, and upper Tertiary strata; coal, salt springs, copper, iron, gold, and silver occur, the two latter metals being confined to the granite and gneissic rocks, possibly of the age of the Laurentian series of Canada. The lodes are wonderfully parallel, the greater portion having a north-east and south-west strike, coinciding with one set of clearage planes. The coal-beds of the west are either lower or middle Tertiary; the associated plant remains, being in some cases identical with the miocene species or genera of Europe—Platanus, Quercus, Populus, Magnolia, Sabal; and the salt springs are considered to belong to the triassic sandstones with gypsum. Mr. Hayden considers there are transition or passage beds, represented by clays and sandstones, between the well-defined cretaceous and tertiary strata, for there is no proof in the western country of any unconformity between them. The wonderful fertility of the soil of a considerable portion of the western territories is

attributed to the yellow marls of the "Bluff formation,"—a deposit considered to be of freshwater origin, and very recent.

The amount of water at different seasons in the Platte river and other western streams is influenced by the geological nature of the country through which they flow; receiving their chief supplies from the upland sources, and but little or none from the lower arid plains, which even absorb the water—the Rocky Mountain regions, in the autumn, present what are called dry creeks, with beds which, when full in spring time, form large rivers.

Two sections of the report are devoted to an account of the mines and minerals and agriculture of Colorado, by Messrs. Frazer and Thomas.

Reports on Observations of the Total Eclipse of the Sun, August 7, 1869. Conducted under the direction of COMMODORE B. F. SANDS, U.S.N. Washington: Government Printing Office.

Photographs of the Total Eclipse of the Sun, August 7, 1869. Surgeon-General's Office, Army Medical Museum, Washington, D.C.

TO the mere outsider a work like that before us may not seem of very much value or importance, but to the astronomer it is the record of a series of observations which, for elaborateness of detail, number, and scientific precision, are unparalleled in the annals of science. In this (to the astronomer) most precious quarto, we have a set of ten reports, made out by the leading astronomical and photographic workers of the United States, and given with a regard for minutiæ which stamps them with a worth far above that of most observations of solar eclipses. Indeed, the work is of such a character that it must, until several subsequent observations lead to the publication of other works of the kind, be the standard authority on the phenomena of solar eclipses. Some of the reports in this volume are from private sources, but they are nevertheless most useful additions to our knowledge.

The Report is generally that of the American *Naval Observatory*, and is under the editorship of Commodore Sands, and the various scientific men who accompanied him to Des Moines, Iowa, where the temporary observatories and photographic laboratories were erected, and the fine equatorial telescope of the Naval Academy was lent for the occasion by Vice-Admiral Porter. Professor Newcomb undertook the observations of the corona and the search for intra-mercurial planetoïds. Professor Harkness did the work with the spectroscope. Professor Eastman carried out the general meteorological observations, and Dr. Curtis prepared the wonderful photographs which now lie upon our table, and which are certainly among the wonders of astronomical sun-pictures. Of the details of the report it is needless to speak, for they are already tolerably familiar to our readers. But of the photographs we may say—and of course we speak of the prints, and not of the negatives—that they are exquisite productions. They are two in number; one represents the eclipse after the commencement of totality, and the second near the end of totality; and the manner in which they depict the solar protuberances is certainly most remarkable. In conclusion, we would point out how creditable to the American Government is the publication of such an admirably-executed scientific report as that which has issued from the Washington State Printing-office.

Public Health: a Popular Introduction to Sanitary Science. By WILLIAM A. GUY, M.B., F.R.S., Professor of Forensic Medicine in King's College, London. London: Renshaw, 1870.

IF any one were to take up this book under the impression that he should find in it such an account of the principles and practice of hygiene as is to be met with in Parkes' well-known treatise, he would be woefully disappointed. Not for the student but the public has Dr. Guy written, and it is only on the *lucus a non lucendo* principle that his work is styled public health; for, from cover to cover, it treats rather of public disease. In a word, Dr. Guy has given us an historical account of the great epidemics which, during the past few centuries, have ravaged civilized populations, and in doing this he has brought his well-known powers as a statistician to show that these great waves of death which from time to time have inundated the shores of life, might have been in great measure prevented by the practice of a rational hygiene. It is in this way that the author has written; and clearly his aim has been to convince the public of the necessity for the establishment of a science of disease-prevention. Some may think that, in doing this, Dr. Guy was performing a work of supererogation; but those who will take this view of the matter are they who know not the dense crust of ignorance and indifference which must be removed before the public become intelligent enough to see the frightful amount of preventible mortality which now exists in civilized society. In point of style this little volume is in the highest degree attractive. It is not merely a collection of dry figures, but it is a graphic narrative of startling facts, chiefly told in the author's clear and forcible English, and frequently illustrated by apt quotation from the older writers, medical and historical, thus showing Dr. Guy's industry and erudition. As we have said, it is an essay in support of a science, it is the *raison d'être* of Hygiene, and is a book which every educated person should read, and from which he will surely derive both pleasure and profit.

Botanical Illustrations. Sheet No. I. Organs of Plants—Tissues, Root, Stem. And also Handbook to Illustrations of Botany. By J. H. BALFOUR, M.D., F.R.S., &c. London: W. & A. K. JOHNSTON. 1870.

MESSRS. JOHNSTON have from time to time conferred benefit on science and saved much unnecessary labour to scientific teachers by the publication of their several Atlases and Illustrations. It seems to us that in no instance more than in the present one have they been successful; and, if the subsequent sheets approach that before us in scientific accuracy and artistic perfection, the series will be one which will meet nearly all the wants of the ordinary lecturer on Botany. Indeed, this first sheet alone contains enough to give a fair general insight into the structure of plants, and it deals with materials enough for three or four well condensed lectures. Dr. Balfour's handbook of explanations will, when complete, form a very convenient text-book. The part now before us treats of the subjects illustrated on the sheet, and is the *beau-ideal* of compressed matter. Both the Sheets and the Handbook have our heartiest commendation and best wishes.

Symons' Monthly Meteorological Magazine. Vol. IV. London: Stanford, 1870.

THIS is the volume of Mr. Symons' Magazine for the year 1869. It is a little mine of wealth for the working and amateur meteorologist, and contains some very interesting illustrations of recent apparatus, some of which we may hope ere long to reproduce in these pages. This journal is essentially the organ of the British meteorologist, and every British meteorologist should rank among its subscribers. It does not deal so much with abstract matter as with those problems of importance to the carrying out of practical observations, and without which scientific records would be useless.

Notes on the Great Pyramid of Egypt and the Cubits used in its Design. By COL. SIR HENRY JAMES, R.E., F.R.S. Southampton: Gutch.

IN this interesting and luxuriously illustrated pamphlet, the author has given a very attractive sketch of King Cheops'

great tomb, and has supplied a number of handsome photo-lithographs, which tell their own tale. The object of the work is to show a marked relation or almost identity [as pointed out by Herodotus (450 B.C.)] between the Egyptian and the Greek cubit. The reasoning by which this view is sought to be established is most ingenious, and would be convincing if, like prophecy, the measurement of the Great Pyramid were not capable of so many interpretations.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

Suspected Changes on the Moon's Surface.—*From* Mr. W. R. Birt.

Sir,—May I solicit the attention of your astronomical readers to the present appearance of a rather conspicuous lunar crater, which is situated west of Theophilus, the northern of three striking objects on the S.W. quadrant of the moon's disk—viz., Theophilus, Cyrillus, and Catharina. The crater in question is marked G by Lohrmann in Section II., and A by Beer and Mädler in their large map. The earliest delineation that I am aware of is by Lohrmann, who gives a ridge adjoining the N.E. border of the crater, but no central mountain. Beer and Mädler, at a later epoch, give a ridge *terminating* at the north border of the crater, and an interior mountain excentrically situated towards the south border. In Rutherford's photogram, March 6, 1865, a ridge is seen *within* the crater, continued from the exterior ridge, as given by Beer and Mädler; the termination of this ridge appears to be concealed by the bright illumination of the interior of the south border. On the evening of May 6, 1870, 8 to 8.20, S.M.T., I made the following record:—"IV. B. Lambda 8, west of Theophilus, is a remarkable crater, a ridge in continuation of a 'crater row' north-east of Isidorus, has penetrated into its interior nearly to its S.E. border. This ridge appears to have been produced subsequently to the formation of the crater, having pushed up its north border." When I recorded the above I had not consulted the beforementioned authorities. I am, Sir, your obedient servant,

W. R. Birt.

Cynthia Villa Observatory, Walthamstow, May 7.

On Velocipedestrianism.—*From* W. J. Barkas, L.R.C.P. Lond.

Sir,—Your correspondent "Bycyclist," in attempting to criticise my letter, has overlooked what I desired most strenuously to enforce, viz., the advisability of bycyclists consulting their medical advisers as to the state of their health, by saying in a sarcastic manner that "medical advisers would not be troubled by the bycycling public." That the "bycycling public" will not consult medical men I am perfectly aware of; but, notwithstanding that, it does not follow that they ought not to do so. The late Dr. White, of Newcastle-on-Tyne, told me, that in his experience (which was very extensive) the diseases of athletes were chiefly consumption and organic heart affections, both of which are affections that are progressive in their nature, and which might be detected comparatively early by an experienced physician; if they had taken the precaution to consult one, their lives might thus have been prolonged an indefinite period by a timely warning.

"Bycyclist" then casually remarks that the word "bycyclism" is shorter than "velocipedestrianism," with which I quite agree *when written*, but let him ask his friends which is the more easily *spoken*. My friends give a unanimous opinion in favour of the longer word.

He thinks my knowledge and experience of mechanical apparatus is small, which is approximately true; but my personal experience of bycycles extends over more than a year's constant practice.

Had your correspondent read the whole of a sentence before he criticised it, such an act might have saved him from ridicule. Let me place before him the whole of the sentence upon which he founds my inexperience. "Before pointing out the advantages of the velocipede, I shall assume that they are of no use for making long journeys, *if at the end of the ride you are to be cool as regards temperature, have all your faculties clear, or your hand steady.*" I think the part italicised sufficiently explains what I desired to have inferred from "long journeys." Suppose "Bycyclist" were a doctor, and had a round of a few miles to go, would he be in a condition to present himself before patients; be in a position to make a diagnosis of a comparatively difficult case, or be able to perform a delicate operation on an eye at the end of it?

I agree with my critic, that a given distance, if not too long, may be passed over in less time and with less fatigue on a bycycle than by walking. Your correspondent concludes with a foolish remark about running to catch the train, which does not require any further comment than that if he were punctual he would not have to run.

I am, &c. W. J. Barkas, L.R.C.P. Lond., &c.

Boro' Bridge, May 14.

Glaisher's (Hall's Improved) Rain Gauge.—*From* Mr. J. J. Hall.

Sir,—In paragraph 8 of my meteorological report, which appeared in Scientific Opinion last week, p. 429, your readers may have noticed, with reference to the diameter and situation of rain gauge, the words "Glaisher's improved," and I therefore beg to give you some particulars of it, which I communicated to the chairman of the Rainfall Committee of the British Association (G. J. Symons, Esq., F.M.S.) some time since, to which he has signified his approval.

The following extracts from my letter, *verbatim*, to that gentleman will, I think, together with some few remarks, fully explain its particulars.

"The improvement to which I refer consists of an *inverted rim*, or *channel* (similar to the one in which the receiver stands), fixed to the

outside cylinder of the receiver, and made sufficiently large to admit of its dropping over the rim, which is fixed to the lower cylinder.

"The reason I suggested this addition was that, on one occasion, while registering the daily rainfall last winter, I was unable to take the receiver off, owing to the already existing channel being partly filled with water which had frozen hard during the night."

I then proceeded to speak of another difficulty, viz., "that water is often found outside of the receiving pot in the cylinder: and I have often questioned whether or not that water has been shaken from the small pipe at the bottom of the funnel, or whether it has resulted from the water in the channel (outside) drawing over, either by the motion of the wind, or in the act of raising the receiver. I have found this to be effectually prevented in the gauge I have described. I believe it to be even more effectual against the loss by evaporation (during all weathers) than the present system."

With regard to the latter remarks, I think that very much depends upon the fixture of the gauge. It may be for want of more rigid fixing in my case that has led to these results. It has been used at some height above the ground.

It is intended that water should be collected in the flange (Glaisher's) I have spoken of, and thus close the gauge against evaporation—a good idea theoretically, but not practically; *vide* Symons's *British Rainfall*, 1868; *Rain Gauge Experiments at Strathfield, Turgiss, Reading*, by the Rev. C. H. Griffith, F.M.S., &c., p. 23—which further establishes my remarks. The absence of outlet for confined air here spoken of might be remedied by drilling small air holes in the bottom of the receiving cylinder and upright flange, but not facing each other.

I have two Glaisher's gauges now in use, fitted with the flange arrangement, and both answer remarkably well. One is stationed at Virginia Water, under my supervision, the other being under my personal care at Richmond.

Since writing to Mr. Symons, I have had the latter (Richmond gauge) fitted with a piece of *helical* pipe in place of the J-shaped pipe, which I think will constitute a further improvement, as it offers no direct opening for evaporation, at the same time offering little or no hindrance to the descent of the rain-water; there are, however, other reasons which I could bring forward in its favour if time and space allowed me, but this, perhaps, will be better explained and understood in a paper which I hope to communicate to you shortly, "On a Proposed New Form of Rain Gauge (the Atmospileometer)," in which a similar, but more extensive idea is shown. I am just about to submit the plans and a description to Mr. Symons.

METEOROLOGY OF APRIL.

I would take this opportunity of stating that the following rainfall amounts were omitted in the "Table of Meteorological Elements;" they are as follows, viz.:—

27th (two days), ·074; 28th, ·005; 29th, ·078; 30th, —,

making, together with the amounts of the 9th and 10th, ·243 in., the monthly total shown in "General Results," page 429, viz., 0·400 in. This occurred through my somewhat hurrying the report, as I was leaving town for a few days. One or two other minor errors appear to have crept in, such as "degree signs" where the figures represent numbers, but in no way to interfere with the legibility of the results; at the same time I think it well to mention this.

I am, Sir, your obedient servant,

JOHN JAMES HALL.

Grosvenor-terrace, Mount Ararat-road, Richmond, Surrey, May 12.

MR. WALLACE ON NATURAL SELECTION.—*From* MR. HENRY H. HIGGINS.

SIR,—In his very interesting and valuable *Contributions to the Theory of Natural Selection*, Mr. Wallace objects to the notion that birds build their nests by instinct. He considers that "much of what has been attributed to instinct in birds can be very well explained by crediting them with those faculties of observation, memory, and imitation, and with that limited amount of reason which they undoubtedly exhibit." He also remarks that "it would be very extraordinary if young birds could live for days and weeks in a nest, and know nothing of its materials and the manner of its construction."

The case of the young bird building its first nest seems to be introduced chiefly as an illustration of the needlessness of appealing to innate instinct as the source of many of the more remarkable habits of animals in constructing their dwellings.

Birds' nests are very wonderful, but not more so than the geometric webs of the various species of garden-spiders, *Epeira*, the young of which are hatched from a cocoon, and make their first appearance in public as a numerous colony, swarming in an envelope of loosely-woven filaments. It cannot be many days before they separate, and each of the brood shifts for itself, constructing a web less in size, but not less perfect, than that of the parent spider. It is needless to describe the marvels of the web of the *Epeira*. In the case of a young spider's first web, observation, memory, imitation, and reason seem to be excluded—what remains but instinct?

I am, Sir, your obedient servant,

Rainhill, May 9. HENRY H. HIGGINS.

METEOROLOGY OF APRIL, 1870.—*From the* REV. F. B. FALKNER.

SIR,—I beg to send you a few particulars of the weather of last month, as deduced from observations conducted by myself in this Midland region.

The circumstances of atmospheric temperature and moisture refer to a stratum of air 4 ft. from the ground. The barometer is 335 ft. above sea-level. The instrument for measuring the intensity of the sun's rays is a maximum thermometer, with its bulb blackened and *in vacuo*, placed about 3½ ft. from the ground. The minimum "radiating" thermometer rests horizontally on a table 3 ft. from the ground, and is freely exposed to the sky. It shows the lowest temperature to which unsheltered vegetation near the earth's surface is subjected at night.

Highest temperature of air, on the 20th	77·0°
Lowest temperature of air, on the 4th	24·5°
Total range of temperature of air	52·5°
Mean temperature of air	50·1°
Highest reading of solar thermometer, on the 20th	123·0°
Lowest reading of radiating thermometer, on the 5th	13·0°
Highest observed reading of barometer, on the 4th	30·20 in.
Lowest observed reading of barometer, on the 9th	29·16 in.
Observed range of the barometer	1·04 in.
Rainfall	0·83 in.
Number of frosty nights	5

There was a short period of sharp frost in the first week of the month; the temperature of the air descending to 24·5° on the morning of the 4th; to 24·7° on the 5th; to 26·5° on the 6th; and to 27·5° on the 7th.

The warmest *night* was that following the 24th day; when the thermometer did not fall so low as 48° between sunset and sunrise.

On the other hand, the *lowest maximum* temperature of the twenty-four hours occurred on the 2nd, when the thermometer did not rise above 54·3° all day.

The greatest observed dryness of the air was at 2 p.m. on the 20th, when the wet-bulb thermometer read as much as 15° below the temperature of the air.

The direction of the lower current of air was variable. Westerly winds were balanced by easterly, and southerly winds by northerly.

The cuckoo is said to have been heard as early as the 14th of April, in this neighbourhood. I did not hear it myself before the 21st or 22nd. The ladybird, which was abundant about four weeks ago, has now almost disappeared from these parts. Vegetation is backward, on account of the protracted drought.

I am, Sir, your obedient servant,

F. B. FALKNER.

Appleby Grammar School, Leicestershire, May 12.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ETHNOLOGICAL SOCIETY.

MAY 10TH.—Special meeting held at the Museum of Practical Geology; Professor Huxley, president, in the chair. Dr. O'Callaghan was announced as a new member. Colonel Lane Fox read a letter from Lieutenant Oliver relative to the destruction of the fine menhir of Le Quesnel in Jersey, described in the last number of the Society's *Journal*; and Sir J. Lubbock and Mr. Mackie made remarks on the importance of obtaining records of the present condition of our megalithic monuments.

Professor Huxley then delivered an introductory address on the ethnology of Britain. He showed that the oldest accounts of the population of these islands prove the existence of two types of people, physically distinct—the one being tall, fair, yellow-haired and blue-eyed, while the other was short and dark, with dark hair and black eyes. This dark type, as exemplified in the ancient Silures, closely resembled the people of Aquitania and Iberia, whilst the fair type bore close physical relation to the Belgæ of North-east France and Belgium; and these, again, resembled the Germani who dwelt on the east side

of the Rhine. The successive invasions to which Britain was subject introduced no new race-element. It is doubtful whether the Roman invasion strengthened the dark or the fair type in the pre-existing population, but it is certain that the invasion of the Low Dutch from the shores of the Baltic strengthened the fair element, as also did the incursions of the Danes.

The influence of the Norman Conquest would be the subject of Dr. Nicholas' communication.

The Rev. Dr. Nicholas then read a paper "On the Influence of the Norman Conquest on the Ethnology of Britain." He first inquired what race-elements were present prior to the Norman invasion, and then what elements were introduced by William's army. From his conclusions on these points, he was led to believe that the effect of the so-called "Norman" Conquest was greatly gainful to the old British or Gallo-Celtic population.

CHEMICAL SOCIETY.[1]

MAY 5TH. — Professor Williamson, F.R.S., president, in the chair. The following gentlemen were elected Fellows:—G. Matthey, T. Steel, T. Allen.

Mr. Brown read a paper on "Vapour Densities," wherein he gave a historical review of the various methods employed for the determination of vapour densities.

Mr. Church communicated "The Analysis of Two Cornish Minerals."

The one, restormelite, was obtained from the Restormel Iron Mines, and may be regarded as a variety of kaolinite, standing nearest to the Lithomarge group. Its specific gravity and its hardness are nearly the same as those of lithomarge. In its percentage of silica and alumina (its chief constituents) it does not differ from that of lithomarge; but, while restormelite contains 7 per cent. of soda and potash, lithomarge contains a mere trace of these alkalies. Mr. Church considers restormelite as preserving in its alkalies more evident traces of its feldspathic origin than we usually find in such alteration-products. The following percentages were obtained in six analyses:—

	I.	II.	III.	IV.	V.	VI.
H_2O.....	11·69	—	11·75	11·64	11·65	—
SiO_2 ...	—	—	44·77	45·66	—	—
Fe_2O_3 ...	—	—	1·11	1·25	—	0·98
Al_2O_3 ...	—	—	35·05	35·66	—	34·58
MgO ...	—	0·92	0·69	0·95	—	—
K_2O ...	—	2·10	2·51	—	—	—
Na_2O ...	—	4·12	4·12	—	—	—

These results correspond pretty well with the formula of kaolinite, $Al_2O_3 2SiO_2 + 2aq.$, if we suppose several replacement, such as a partial replacement of hydrogen by sodium or potassium, and of aluminium by iron.

The other of the above-mentioned minerals is chalcophyllite. The recorded analyses of this mineral are by no means satisfactory. Chevenix found in it 58 per cent. of cupric oxide and 21 of water; Hermann, 44·45 per cent. of CuO and 31·19 of water; and Damour, 52·61 of CuO and 23·26 of water. Of course it was rather difficult to assign a formula for so variable a substance. Mr. Church has devoted much time and labour to an endeavour to clear up the mystery of its constitution; and he obtained the following percentages as the mean of several analyses:—

H_2O (lost at 100°)	14·06
CuO	46·14
Al_2O_3	5·97
Fe_2O_3	0·60
As_2O_5	15·54
H_2O (by difference)	31·75

These results lead to the formula—

$$8CuO, Al_2O_3 As_2O_5 + 24aq.;$$

or as well to $8CuO, Al_2O_3, As_2O_3 + 25aq.$; and these elements of chalcophyllite may be viewed as arranged in the following manner:—

$$\left.\begin{matrix} Cu_3(AsO_4)_2, 6aq. \\ 5CuH_2O_2 \\ Al_2H_6O_6 \end{matrix}\right\} + 11aq.;$$

Or

$$\left.\begin{matrix} Cu_3H_2(AsO_4)_2, 5aq. \\ 6CuH_2O_2 \\ Al_2H_6O_6 \end{matrix}\right\} + 11aq.$$

It ought to be stated that chalcophyllite cannot be dried, even *in vacuo*, without an entire change in its appearance; the transparent beautiful green crystals become opaque and of a more bluish green. These changes correspond to a loss of 13·79 per cent. of water. At 100° the insignificant further loss of 0·81 per cent. of water takes place.

[1] From the *Chemical News*.

Messrs. Bolas and Gloves communicated a paper on "Tetrabromide of Carbon."

This combination is obtained (1) by heating bisulphide of carbon with bromide of iodine, in a sealed tube, to a temperature of 150° C. for about forty-eight hours; (2) by heating bromopicrin with bromide of iodine in a flask furnished with a digestion-tube till the reaction is completed, which is indicated by the disappearance of the bromopicrin; (3) by heating bromoform with bromide of iodine, in a sealed tube, to about 150° C. for twenty-four hours.

In all the above processes terbromide of antimony may be substituted for the bromide of iodine. The tetrabromide of carbon is obtained in a pure state by distillation. It is a white substance, crystallising in lustrous plates, melting at 91° C., of an ethereal odour, somewhat resembling that of carbon tetrachloride, and of sweetish taste. It does not dissolve in water, but readily in ether, hot alcohol (from which it is deposited, on cooling, in the crystalline state), carbon bisulphide, chloroform, bromoform, benzol, and American oil. Sodium amalgam reduces it to bromoform, and then into methylene dibromide.

The authors propose to carry on their investigations of this interesting compound.

ROYAL GEOGRAPHICAL SOCIETY.

A MEETING was held of this society on Monday week, Sir Roderick Murchison, president, in the chair, at which Mr. Consul Swinhoe read a paper on his official mission last spring to the Upper Yank-tse-Kiang, to examine the trade resources of the river. He ascended to Hankow, in the Salamis, with Admiral Sir Henry Keppel, and continued his voyage thence in the gunboat *Opossum*. The *Opossum* reached the town of Ichang, about 900 miles from the sea, being the first vessel that had accomplished the navigation, although it had been known since Blakiston's report that the Yangtse was navigable to that port. Beyond Ichang the great river is contracted between walls of rock, and the current runs with great rapidity. The Chinese pilot refused to take the gunboat further; and the rest of the journey to Chungking, in Sze-chuen, was performed in a native boat, which was "tracked" through all the difficult places. Two naval surveyors (Messrs. Dawson and Palmer) accompanied Mr. Swinhoe, and after examining the rapids they reported that steam navigation could not be carried on in the Yang-tsze beyond Ichang. Mr. Swinhoe, with two delegates from the Shanghai Chamber of Commerce, reached Chungking, and were well received there by the Chinese authorities and traders, who gave much information about the routes, products, and trade of this remote province, all of which is contained in a report by the delegates published at Shanghai.

After the paper, Mr. T. T. Cooper, who had recently returned from Assam, after having in vain attempted from both sides to cross the tract of difficult country lying between China and British India, spoke of the possibility of the gorge of Ichang being made navigable by the removal of rocks that cause the obstructions, and said there was a long extent of fine navigable river beyond the gorge.

In reply to questions concerning the production of opium in Sze-chuen and the prospects of its interfering with our Indian trade in this drug, he replied that the opium of Sze-chuen was of weaker quality and so heavily taxed by Mandarins in descending the river that it could not compete in Eastern China with the opium brought from India.

A second paper was read by Mr. W. A. Whyte on his journey last October from Tien-tsin to Kiachta, across the Desert of Gobi.

Admirals Sir William Hall, Bethune, and Collinson, Mr. George Campbell, Mr. W. Lockhart, and Mr. Robert Michell took part in the discussion on the two papers.

At the conclusion of the meeting the President informed the members of a fact which he said would gratify both them and the public, that in consequence of an appeal which he had made to the Earl of Clarendon, her Majesty's Government had determined to afford the means of relieving the great traveller Livingstone by sending supplies to him at Ujiji from Zanzibar. This announcement was received with loud cheers.

The following fellows were elected:—William Henry Bishop, Sir Bruce Chichester, Charles Dibdin, R. W. Dibdin, Claud Erskine (Bombay) Civil Service), Captain T. A. J. Harrison, R.A., Campbell Hepworth, C. E. Lamplough, F. I. Palmer, R.N., Edward Shearne, Raymond West, Captain T. P. Wood.

RECENT LECTURES AT THE ROYAL INSTITUTION.

PROFESSOR JOHN S. BLACKIE, of Edinburgh, has finished his course of four lectures on Moral Philosophy. He went in a somewhat rambling style over the well-trodden ground of the ancient Greeks, showing the contrast of Socrates's teachings with those of modern Utilitarians, and gave his opinion of both. His repeated hints at James and

John Stuart Mill, and even at the present modes of treating science, left little doubt as to his estimation of modern views. If Professor Blackie is an authority on the subject, the world is going the wrong way. He included Christian ethics in his programme. The root of these were religion, and the most patent levers of Christian morals were Monotheism, a historical Saviour, and a future life. Among the abuses of Christian ethics, he mentioned Sectarianism, Orthodoxy, and Ritualism. The latter he declared to be an outgrowth of Judaism. His closing lecture was devoted to modern representatives of moral and political philosophy.

Professor Tyndall's lectures, which commenced three weeks ago, and which are delivered on Thursdays at three o'clock, increase in interest. The subject is "Electrical Phenomena and Theories," and the experiments are, as usual, of the very best description. The hydrogen bubbles rising from the surface of platinum when in contact with zinc, both being immersed in acidulated water, were made visible to the audience by being illuminated, and their image thrown on a screen. De la Rive's explanation of what is going on in a bar of iron on its being magnetized, was said by the lecturer to be as true as it was acute. On being magnetized, such a bar is altered in shape; and although the change which it undergoes is imperceptible under ordinary circumstances, Joule discovered and observed the elongation by means of levers and a microscope. Professor Tyndall, in his experiment, also uses a lever, augmenting the elongation fifty-fold. This motion he applies to turn an axis on a rotating mirror, from which a long beam of light is reflected, which forms an index without weight. Thus, on the iron bar being magnetized by an electro-magnetic helix surrounding it, a displacement of the reflected beam was obtained on a white screen, amounting to several inches. A beautiful experiment in corroboration of the theory that, on being magnetized, the particles of an iron bar try to set their longest dimensions parallel to the direction of magnetization, was shown by Professor Tyndall. In a cylindrical vessel, with flat glass ends, magnetic oxide of iron was suspended as a powder in water. This vessel was surrounded by a coil of covered wire. On contact being made, it is supposed that the particles arrange themselves as stated above with regard to the iron bar. The lecturer sent a beam from an electric lamp through the muddy liquid, whereupon a magnified image of the end of the cylindrical cell appeared on the screen. This illuminated disk changed its appearance on contact being made. It became much brighter, or, in other words, the liquid allowed more light to pass through it; which, in the described arrangement of the particles within the vessel, would find its explanation. The attraction and repulsion of same and opposite electricities was illustrated in a homely and yet striking manner. A lath was placed on the convex side of a watch-glass, in equilibrium, and so as to yield readily to a slight action. A stick of rubbed sealing-wax was brought near one extremity of the lath, which followed its scarlet enticer at a pace, as if desirous of annihilating the disturbing dwarf, much to the amusement of the crowded audience.

ROYAL INSTITUTION OF GREAT BRITAIN.

Monday, May 9.—General monthly meeting, Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., president, in the chair. Thomas William Boord, Esq., F.S.A., Miss Eliza Bowman, Miss Margaret Graham, Rev. Brenchley Kingsford, M.A., Henry Francis Makins, Esq., Reginald Heber Prance, Esq., the Earl of Rosse, F.R.S., the Hon. Captain Reginald Talbot, M.P., the Hon. Percy S. Wyndham, M.P., were elected members of the Royal Institution. John Tyndall, Esq., LL.D., F.R.S., was re-elected as Professor of Natural Philosophy. The presents received since the last meeting were laid on the table, and the thanks of the members returned for the same.

THE INSTITUTION OF CIVIL ENGINEERS.

May 3rd.—Charles B. Vignoles, Esq., F.R.S., president, in the chair.

The paper read was "On the Strength of Iron and Steel, and on the Design of parts of Structures which consist of those materials," by Mr. George Berkley, M. Inst. C.E.

The author stated that the strength of wrought iron varied with the quantities of work involved in the production of the form of the material tested. This was proved by the fact that a bar of iron 1 in. square, which would break with a strain of 26 tons, would, if drawn down to the form of wire $\frac{1}{10}$ in. in diameter, bear a strain of 40 tons per square inch. The strength to be relied on in practice would probably be best represented by the minimum strain that 1 square inch would bear without rupture, and by the amount of stretch which would take place in a given length before it broke. Iron could be obtained, at the current market rates, which would bear the following strains:—For plates, an average breaking strain of 20 tons per square inch, and a minimum breaking strain of 19 tons per square inch, and an average stretch of 1 in. in 12 in. lineal. For L and T irons an average breaking strain of 22 tons per square inch, and a minimum breaking strain of 21 tons per square inch, and an average stretch of $1\frac{1}{4}$ in. in 12 in. lineal. For rivet iron an average breaking strain of 18 tons per circular inch. For bars intended for chains, couplings, &c., an average breaking strain of 22 tons per square inch, and an average stretch of $1\frac{3}{4}$ in. in 12 in. lineal. For ordinary classes of work, let at competitive prices, stronger iron could only be obtained with difficulty.

NEWCASTLE-ON-TYNE NATURAL HISTORY SOCIETY.

Annual Meeting.—On Tuesday, May 10th, the anniversary meeting of the Northumberland, Durham, and Newcastle-upon-Tyne Natural History Society was held at the Museum, Westgate-street, Newcastle. Mr. I. L. Bell, V.P., in the chair.

Mr. A. Freire Marreco, one of the hon. secretaries, read the following report:—

"Your committee have again to chronicle a season of comparative prosperity in the affairs of the society, unmarked by any very special event. The treasurer's statement, herewith presented, shows a balance in hand, notwithstanding a number of important improvements involving outlay, which have been effected during the past year. The museum still continues to be largely frequented by the public; notwithstanding the charge for admission, 13,640 persons having paid at the doors, besides members and their friends. It is fairly *open to question*, however, whether this number would not be *still further increased* were the doors opened free on certain days, as in some museums. The average income from this source since 1863, when the charge was first fixed at its present amount, has been about £120, an important item in the society's present balance-sheet, but one with which a very moderate share of a museum rate would enable it to dispense, at any rate in part. The winter evening meetings have been continued during the past season, and have been fairly attended by members and their friends as heretofore; but the difficulty—which increases every year—of obtaining the services of suitable lecturers, has necessitated the omission of one meeting; and your committee fully anticipate that some change in the arrangements will be required at no distant date. The most important among the donations to the museum have been the late Mr. Loftus's collections of fossils, Sir W. G. Armstrong; skeleton of bottle-nose whale, Messrs. J. Rogerson and Plumpton; skeleton of great northern Norqual, S. Langdale, Esq.; cast of skull of *Physeter bidens*, Sir W. C. Trevelyan; fasciculus of British willows, the Rev. J. F. Leefe; cases of Eozoon, Canadense, *and Leftusia*, H. B. Brady, &c. Your committee would here impress upon members and the public the valuable aid which may still be given in this way. To take a single instance. Many varieties of common British birds are still unrepresented in the museum, though one often hears of their being obtained in our more or less immediate neighbourhood. Assistance in obtaining desiderata, either by presentation or purchase, is much required. Through the kind assistance of Joseph Duff, Esq., of Etherley, a very valuable collection of fossils has been acquired from Middridge Quarry, at the almost nominal cost of £10. Among the specimens, some of which are absolutely unique, are—Reptiles: *Protosaurus spineri*, new to England; *Protosaurus Huxleyi*, new species. Amphibians: *Lepidotosaurus Duffii*, new genus from magnesian limestone. Fishes: *Janassa bituminosa*, Schloth; and *Acrolepis exsculptus*, Gumar, new to the marl slate of England. Numerous specimens of the genera Pygopterus, Palæoniscus, Platysomus, Cœlacanthus, and many interesting plant remains. No other important acquisitions have been made by purchase. In the vertebrate collections, the British mammals have been arranged in the south gallery by Mr. John Hancock. Several species and varieties are wanting, which your committee hope may be soon supplied. Mr. Hancock has also brought together, as a classical collection, the British birds figured from by Bewick, with the exception of the Red-breasted Goose and Little Bittern, of which the society does not possess duplicates, and which are therfore for the present retained in the general collection. In the invertebrates, Mr. D. P. Morison is now occupied in arranging the entomological collections in the new drawers which have been specially constructed for them. Your committee have under consideration certain changes, which they trust will still further increase the value and usefulness of the museum. A small printing-press and type have been purchased, for labelling purposes; and your committee hope before long to effect considerable improvement in this important particular. It is proposed to take down a large number of the foreign birds, and deposit them in the drawers set at liberty by the removal of the insects to their new position. The space thus gained may, it is thought, be utilized for a zoological type collection of an elementary character, to be provided with clear and full descriptive labels. It is also proposed to arrange, in one or more of the mineral cases, a students' collection of the commoner minerals, with a view of obviating the confusion produced on beginners by numerous duplicates and varieties. Having regard to the labour which these improvements will entail, your committee are of opinion that the time has arrived when a porter may with advantage be engaged, so as to set the keeper more at liberty. Lastly, your committee have under consideration the

possibility of publishing a short descriptive catalogue of the museum, with a view to the assistance of members and visitors in the examination of its contents. Your committee cannot close this report without expressing their regret at the loss of Mr. George Hodge's services as hon. secretary, which has been entailed by his removal to a distance. They trust, however, that this will not prevent his lending valuable assistance in the arrangement, &c., of the collections of Radiata."

Mr. Blacklock, the treasurer, then read the financial report, which showed that the balance in hand in July 1868 was £102. 5s. 10d.; and at the end of the same year £156. 0s. 3d. The receipts, including balance at the end of 1869, were £560. 14s. 9d., leaving a balance in hand of £200. 5s. 8d. The receipts from subscriptions and admissions to the museum for the present year had been £95. 9s. 3d., and the expenditure £191. 15s. 10d., leaving a balance in hand of £103. 19s. 1d.

The Chairman remarked that financially the society was in a most satisfactory position; but he did not think that it occupied that position in public estimation to which it was justly entitled. So far as British birds were concerned, the museum was equal, if not superior, to the collection in the British Museum. It seemed a very disheartening position, therefore, for the society that the numbers of its members had dwindled as it had done. The Newcastle, Durham, and Northumberland Natural History Society was at the present time virtually composed of a very small class of individuals.

Mr. Albany Hancock remarked that twenty years since the society comprised 300 members. At the present time it had not 150 members.

The Chairman believed that out of the 13,000 persons who visited the museum last year, hardly 1,300 belonged to Newcastle.

The reports, having been formally moved and seconded, were adopted.

It was unanimously agreed that the list of officers and committee for the ensuing year stand as for 1869, with the following exceptions, namely—Mr. A. Freire Marreco, in place of Mr. George Hodge, as one of the hon. secretaries; Mr. Hodge placed on the committee, *vice* Mr. J. H. Richardson; and Mr. William Dinning added to the corps of curators.

On the motion of Mr. Albany Hancock, seconded by Mr. Newall, a committee was appointed, consisting of Mr. Tristram, Mr. Hancock, Mr. Abbs, and Mr. Norman, to prepare a petition to Parliament, with the view of putting a stop to the wholesale destruction of birds in country districts.

Mr. Glover remarked that effectual measures ought to be taken to secure the museum against ravages by fire.

RICHMOND AND NORTH RIDING NATURALISTS' FIELD CLUB.

THE monthly meeting of this society was held in the Museum on Tuesday evening, the 10th inst., the president, Mr. Wood, F.G.S., in the chair. The meeting on this occasion was of unusual interest, on account of the president having just returned from a prolonged visit to one of the most scientific noblemen in Ireland. He brought over for the club a great many objects of interest, and gave a long description of Ireland, with its people, its bogs, and its wonderful coast scenery, particularly describing and exhibiting minerals, stone implements, and photographs from its two great northern attractions, the Giant's Causeway and Carrick-a-Rede. The Causeway, though full of interest, he considered very inferior to Staffa. On the table were specimens of stone implements, a gigantic wild boar's head, and oak and yew from the Enniskillen bog. Both of the trees are there of immense size, undoubtedly coeval with man, as marks of fire are sometimes upon them. Specimens of felspar, in different stages of manufacture, and superb works of art, assisted a description of the world-famed Belleek pottery. Likewise a bronze celt, from Drogheda, stone implements, and mesotype from the Causeway, and serpentine marble from Donegal. The wonderful identity between the first traces of man in Europe, and the implements now in use in some of the South Sea Islands, where metals are unknown, was pointed out, as on former occasions. Mr. W. Horne, of Leyburn, exhibited a fine series of carboniferous fishes' teeth, from Wensleydale. The president complimented this gentleman upon their beautiful preservation and the skill with which they had been removed from the matrix, and stated that he (the president) had been fortunate enough to discover, in quarries near Richmond, a new genus, described by Agassiz, the *Pristodus falcatus*; and, though he was very familiar with this genus, the series on the table were much finer than any that had yet been discovered. Mr. Kirkham, of Manchester, sent a particularly rich specimen of lead ore, from Nent Head. The president stated that he hoped before the next monthly meeting to complete arrangements for an excursion of the club to Flamborough Head.

EDINBURGH BOTANICAL SOCIETY.

THE society met on Thursday, 14th April, at 5, St. Andrew-square, Sir Walter Elliot, president, in the chair. The following communications were read:—

"On the Flowering and Fruiting of *Aucuba Japonica*," by Mr. P. S. Robertson.—The author had observed that recently introduced female plants from Japan (grown in a coal-pit) came into flower in January and February, while the male plants, grown in the same circumstances, never came into flower till the middle of March. Yet he had every year obtained a crop of young seedlings from the berries, although the female flowers were quite shrivelled before the male ones expanded. He found that the common spotted variety, long grown in this country, did not flower till May or June, although grown in the pit or house with the others, and begins to expand its flowers when the males are getting past; yet it also never fails to produce a crop of fruit with perfect seeds. He thought that the pollen must lodge for some time in the scales of the unopened flower-buds, or reaches the pistils before the flowers are expanded; but how to account for the fertilizing of the early flowering varieties he was at a loss. This year he had forced on the flowering of the male plants by placing them in strong heat, and had all the varieties of the male and female plants in full flower at very nearly the same time, and accordingly anticipates a much larger produce of berries than in former years, when they were left to the ordinary course. He exhibited a branch bearing berries with perfect seed; yet when that plant came into flower, there had not been a male plant in the house where it grew for fully a month previously.

Mr. Sadler stated that he had been informed by the Messrs. Lawson that where there was a great lapse of time between the flowering of male and female Aucuba plants, they frequently collected the pollen and kept it wrapped in paper until such time as the female flowers were ready for fertilization, when it was applied to the stigmas, and thus secured invariably a crop of fruit with perfect seeds. By grafting the male plant on the female, the two kinds of flowers might expand nearly at the same time.

"Remarks on *Grimmia pruinosa* (Wilson's MSS.)," by Mr. William Bell.

"Remarks on *Boehmeria nivea* (*Urtica nivea* of Linnæus)," by Mr. Sadler. Mr. Sadler exhibited raw and prepared fibres of the Boehmeria, as well as articles of dress manufactured from it, and drawings and specimens of the plant. He stated that it was a plant which was attracting a good deal of attention at the present moment, both in this country and abroad, from the fact that the Government had lately offered an award of £5,000 for the invention of a machine capable of separating the fibre from the bark and stem in an inexpensive manner; the working expenses of the prepared fibre not to exceed £15 per ton, and to be of such quality as to realize not less than £50 per ton in the English market. The offer of this premium was issued from the India Office in February last, and one year given to competitors; but he regretted to see it stated in the newspapers about three weeks ago that a gentleman in Bombay had invented a machine such as was required. He thought that the Government ought to contradict such a statement, as he believed that it had the effect of stopping many intending competitors in their inventions.

Mr. Sadler went on to describe *Boehmeria nivea* as a herbaceous plant, belonging to the natural order Urticaceæ, and indigenous to South-Eastern Asia. He referred to the other fibre-yielding plants belonging to the same natural order, and exhibited a scarf manufactured from the fibre of the common nettle (*Urtica dioica*), which he described as a fine and soft, but not lasting, fibre. The Boehmeria is known as "Rhea," "Ramie," "Ma," or "Chu-ma," "Chinese grass," and "Chinese nettle." Several notices of the plant have recently appeared, and Mr. Sadler particularly noticed a paper by Mr. George King, M.B., published in the *Journal of the Agricultural and Horticultural Society of India*, vol. i., part 4, and the full description of the plant, and mode of preparing its fibre, as given by Dr. Royle in his *Fibrous Plants of India*. Dr. King states that naturally twice, but under cultivation three, four, or even five times a year, according to climate and soil, a fresh set of stems shoot up from the root. The proper time to cut the old twigs for their fibre is when they begin to become brown at their bases. In the Government Gardens at Deyrah Dhoon, where the object aimed at has been the propagation of the plant, and not the extraction of its fibre, the stems have hitherto been cut down only twice a year. If, however, it was well watered and manured, three crops (as is the case in China) might be obtained. In the moist climate of Assam, four or five crops may be obtained. The plant is hardy, and thrives well in parts of India, differing so much in climate and other physical conditions as Assam, Bengal, the North-West Provinces, and the Kangra valley in the Punjab. It has also been introduced with success in the Madras Presidency. In Deyrah Dhoon some old plants throw up shoots from 8 to 10 ft. high, 6 ft. being the common height. An 8 ft. shoot, if carefully manipulated, will yield a fibre 6 ft. long.

Dr. King next notices the limit of its growth, and the soil and climate best suited for it. In speaking of its propagation and cultivation, he states that the plant is monœcious, and that seed is uncertain in localities where the insects are not indigenous, by which fecundation is probably for the most part accomplished. In districts where Boehmeria has been introduced, propagation has therefore been con-

ducted not by seed, but by cuttings, and by the division of the roots of old plants. Scarcely one of the cuttings ever fails to strike. The cost of cultivation, and the probable produce per acre, are next considered by the author. Major Hannay estimates the expense at £14 per ton, and reports that Rhea can be produced and sold with profit at as cheap a rate as Russian hemp. Dr. Royle, however, states that this must be a mistake, and that £28 were meant. Captain Jenkins puts down the cost at £28 per ton, while Captain Dalton states that the lowest price at which it is likely to be procurable by purchase from the cultivator is 6 annas a seer, or about £48 per ton. Dr. King notices further the process of separating the fibre from the plant, and its cleaning and bleaching, and concludes by relating some experiments which have been made in the manufacture of the fibre, and points out the chances of its success in a commercial point of view.

"Memorandum on Ipecacuanha," by Clements R. Markham, Esq.; communicated by Dr. Cleghorn.

"Report on the Open-air Vegetation at the Royal Botanic Garden," by Mr. M'Nab.—Since the last meeting of the Botanical Society (March 10), the temperature has been somewhat variable. On nineteen mornings the thermometer has been below the freezing-point, the lowest being on the 12th, 13th, 14th, 23rd, 27th, and 28th of March, falling respectively to 24°, 25°, 23°, 27°, 24°, and 27°, while the six highest temperatures were, on the mornings of 16th and 31st March, also 1st, 8th, 12th, and 14th of April, standing respectively at 40°, 40°, 41°, 40°, 47°, and 49°. Having more sunshine during the past month than during the previous markings of this year, vegetation, in consequence, has made considerable progress, although still behind last year, as exemplified by the following register. In the forest and ornamental tree departments the foliage is still very backward, even more so than has been at this date for many years.

	Date of Flowering. 1870.	Date of Flowering. 1869.
Tussilago nives	Mar. 14	Feb. 26
Symplocarpus fœtidus	,, 18	,, 11
Populus tremula	,, 18	Jan. 21
Nuttallia cerasiformis	,, 20	Feb. 7
Sisyrinchium grandiflorum	,, 23	,, 1
Andromeda floribunda	,, 23	Jan. 17
Narcissus pumilus	,, 24	Feb. 28
Sisyrinchium grandiflorum album	,, 25	,, 20
Scilla bifolia, blue	,, 25	,, 3
Scilla bifolia, major	,, 25	,, 21
Narcissus minimus	,, 26	,, 20
Daphne Mezereum	,, 27	Jan. 29
Scilla bifolia alba	,, 27	Feb. 21
Scilla sibirica	,, 28	Mar. 2
Scilla bifolia rubra	,, 28	,, 8
Corydalis cava	,, 28	,, 4
Muscari botryoides	,, 30	Feb. 28
Puschkinia scilloides	April 1	,, 29
Gagea lutea	,, 2	Mar. 5
Erythronium dens-canis	,, 2	,, 6
Rhododendron nobleanum	,, 2	Jan. 16
Aubretia grandiflora	,, 2	Feb. 10
Orobus vernus	,, 3	Jan. 25
Mandragora vernalis	,, 3	Mar. 2
Druba aizoides	,, 4	,, 11
Cydonia japonica	,, 4	Jan. 30
Tritelia uniflora	,, 5	Mar. 28
Ribes sanguineum — first flower seen open on standard plant	,, 6	,, 1
Adonis vernalis	,, 8	,, 18
Muscari botryoides alba	,, 8	,, 5
Mahonia aquifolium	,, 8	Jan. 30
Hyoscyamus scopolia	,, 9	,, 19
Omphalodes verna	,, 9	,, 10
Symphytum Caucasicum	,, 10	,, 10
Hyoscyamus orientalis	,, 11	Mar. 10
Pulsatilla vernalis	,, 11	April 6
Muscari racemosum	,, 12	Mar. 25
Anemone nemorosa	,, 12	April 3
Pulmonaria virginica	,, 12	,, 1
Narcissus moschatus	,, 13	Mar. 16
Carex montana	,, 14	April 1
Primula nivalis	,, 14	—

"Remarks on the Embryos of the White Water-lily (*Nymphæa alba*), and the Date Palm (*Phœnix dactylifera*)." By Prof. Dickson.

Miscellaneous Communications.—Professor Balfour communicated a letter which he had received from Dr. Gambleton Daunt, dated San Paulo, Brazil, 19th November, 1869. Mr. Daunt says:—"I inclose you some seeds of the Herva de Lagarto, or Lizard plant, whose leaves the lizard (a large variety) masticates and eats during or after its combats with venomous snakes. The people of the country say that it is an antidote to all serpent poison, and a Saxon apothecary here avers that, when engaged in a natural history commission in the island of Santa Catharina, by order of the Dresden Government, he was stung by a serpent, and saved his life by swallowing the juice of the leaves of this plant and applying the pulp of the leaves to the wound. The seeds should be planted in the greenhouse, not in the hothouse. Senhor Correa de Mello of this place succeeded in rearing a specimen of the (Physostigma) Calabar ordeal bean plant, which flowered and then died."

In a letter to Professor Balfour, dated *Mentone*, 28th March, 1870, Professor Allman says:—"Spring is rapidly advancing among the Mentone valleys. It would be worth coming here at this season, if it were for nothing else than to see the peach-trees in flower, all standard trees, covering the country like orchards in Devonshire, and filling every glade upon the hill-side not already occupied by the bright green lemon and orange, with a marvellous flush of blossom. The woods are filled with the anemones, blue and scarlet, and the very air is fragrant with the sweet violet. I think the most remarkable plant here is an arborescent Euphorbia, which covers the most arid rocks, but which is singularly limited to a small district along the coast."

Mr. Peach exhibited a stone which he had detached from a rock near Stromness in August, 1856, on which were clearly printed figures of *Desmarestia aculeata* and *D. viridis*. The weeds themselves had been thrown and spread on the rocks by the flowing tide, and thus left and printed before the next return had again covered them, and thus time was given for the process before the remains of the printing weed was washed away. He saw a great quantity both of the weeds and pictures, and which covered wide spaces of rocks. They were mostly Desmarestias. The specimen presented before printing was covered by a Ralfsia, which formed a nice dark ground, and contrasted beautifully with light-coloured figures left by the Desmarestias; and although this slab had been in his possession fourteen years, and not varnished or protected in any way, it is as fresh as when first got. He had observed rocks in some parts of Caithness covered with printed sea-weeds, without being covered with Ralfsia or other matters. He thought that this process was interesting to geologists as it assisted to throw much light on similar plant-markings often seen in newly-quarried rocks, even so low down as the old red sandstone and silurian, and shows how they might have been formed.

Mr. Adam White, who had lately paid a visit to Ben Ledi, in Perthshire, gave some account of the spring vegetation on that mountain, and noticed particularly some of the rare mosses he had observed.

A letter was read from Mr. Frere Hall, Diss, *transmitting* specimens of eight different "dogwoods" from the Government powder works at Waltham Abbey, for examination. Mr. Sadler stated that he had examined these woods and found them all to be *Rhamnus Frangula*. A nurseryman in Edinburgh had lately received a large quantity of the plants of *Cornus mascula* as the gunpowder "dogwood." He was not aware, however, that the wood of this species was ever used for powder-charcoal, and thought that the plants must have been sent by mistake. The wood of Rhamnus was easily distinguished from that of Cornus, from its becoming yellow when moistened, and having coloured medullary rays, and alternate branches.

Mr. A. Oswald Brodie, exhibited drawings of the foliage, flowers, and fruit of a species of Adamsonia, which he found growing at Putlam, in Ceylon, in 1847. The tree was of a great size, and was blown down in 1860.

Professor Balfour exhibited a specimen of wood covered with beautiful delineations from impressions of native ferns, executed by Miss Tulloch, and sent by Mr. Western.

Mr. Frere presented a bundle of what watchmakers call "pegs," or "pegwood," and used for cleaning the pivot-holes of watches. The wood is remarkably free from silex, and makes good crayons, when charred, for artists. It is probably a species of Cornus, and is imported from the Continent.

Mr. D. A. Watt, Montreal, presented specimens of *Cystopteris montana* and *Botrychium Lunaria*, from Lake Superior.

Mr. James Cox, Clement Park, Dundee, exhibited and presented a stem of *Corchorus capsullaris* (jute plant), measuring upwards of 11 ft.

CANADA NATURAL HISTORY SOCIETY.

THE last of the regular meetings of the above society for the present session was held at its rooms on Monday evening, April 25th, Rev. Dr. De Sola presiding.

Among the donations to the library was a copy of *Hooker's Illustrations of Rare Plants*, presented by E. Hartley, of the Geological Survey of Canada.

John Thomas Molson was elected a life member, Gordon Broome, F.G.S., and James Dakers, ordinary, and Alfred Bell (London, England), a corresponding member of the Society.

Dr. Smallwood read the first paper, "On some phenomena of the Solar Eclipse of August, 1869." It was intended to illustrate more fully a paper which he had contributed to the *Canadian Naturalist*, referring to the rose-coloured prominences of the sun's chromosphere,

and their appearance before first contact. He exhibited diagrams of the several eclipses of 1851, 1860, 1868, and 1869, which showed the various shapes of the protuberance, and referred more particularly to the large one observed during the eclipse of last August, some 30,000 miles high, which was seen in a direct line with the passage of the moon across the sun's disk. He attributed the appearances which were observed a few seconds before the first contact of the moon with the sun's true limb, to this circumstance, and cited and illustrated the experiments of Norman Lockyer and Janssen, in confirmation of this opinion. The remarks of the astronomer Ropal, on the causes which, up to 1861, had prevented these prominences being seen, except during a solâr eclipse, were quoted from the *Transactions* of the British Association. The spectroscope and other optical appliances have now made it possible to examine these phenomena at any time when the sun is shining. The experiments of Lockyer and Janssen seem fully to bear out the conclusions to which Dr. Smallwood had arrived, and the lecturer ended by expressing a hope that observations made on the eclipse of next December would tend to illustrate further the somewhat unusual appearances which he had recorded.

The Acting President made some remarks on the above paper, and expressed his regret at the want of good astronomical instruments in the city.

Mr. A. S. Ritchie then read a paper entitled "Aquaria Studies, No. 1." After some preliminary remarks, the principles upon which a fresh-water aquarium should be constructed and stocked were explained in detail, and particulars were given as to how the balance between animal and vegetable life might be best maintained. The author went on to describe some of the peculiarities of the larger tenants of his own aquarium. Commencing with the fishes, the various points of interest connected with the habits of several of the smaller Canadian fresh-water fishes were dwelt upon at some length. The species described were a new Stickleback, lately described by Principal Dawson, in the pages of the *Canadian Naturalist*; the darter, a fish which has no air-bladder, and swims by jerks; the striped minnow, the sun-fish, American perch, black bass, cat-fish, pond-sucker, the black minnow, a species allied to the pike; and, although not a Canadian species, the gold fish. Illustrations were also given of the behaviour in captivity of the painted turtle, the water newt, the shad frog, and the American crayfish. In conclusion, the lecturer stated that in No. II. of Aquaria Studies he hoped to give descriptions of the microscopical denizens of his miniature pond.

A vote of thanks to the authors of the two papers read brought the proceedings to a close.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

PARIS, MAY 9TH.—M. Elie de Beaumont opened the meeting. M. Croullebois replied to some criticisms made by M. Jamin on the experiments by means of which he proved the existence of a maximum in the value of the index of refraction of water at the temperature of the maximum of density. M. Croullebois also observed that the experiment of the prism made by M. Cornu was considered by Arago himself as insufficient, in not affording the amount of precision required in such researches.

M. Delaunay presented, on the part of M. Sonrel, some photographs of the sun taken day by day, and which show clearly the changes which, from one day to another, appear on the surface of the disk. He also presented a note by M. Respighi, containing a new theory on the scintillation of the stars, and a note by another author on the atmospheric phenomena called *pluies de sang*.

M. Henri Sainte-Claire Deville presented a work by M. von Baumhauer on volumetric analysis, confirming the results already obtained by Gay-Lussac, Dulong, and others. He also presented a note by M. Georges Guéroult, on the musical temperament.

M. Fizeau remarked that the observations presented by Father Secchi at the meeting of the 25th of April, contain results which differ from those made by himself.

M. Cahours brought forward a paper by M. Hoffmann, on cyanuric ethers.

M. Ch. Robin presented some experiments by MM. Legros and Onimus on choreic movements under the influence of electric currents.

M. Regnault brought forward a note by M. Pfaundler, explaining his experiments for determining the specific heat of liquids and gases —experiments the results of which are not in accordance with those lately obtained by M. Hirn, and also by MM. Jamin and Amaury.

ROYAL ACADEMY OF BELGIUM.

MARCH 5TH.—M. Stas in the chair.

The Minister of the Interior forwarded, on behalf of M. le Baron Larrey, a discourse delivered at the inauguration of Dupuytren's statue. The International Congress of Geographers, which will be held at Antwerp in August, sent in its list of questions to be discussed. M. Adolphe de Boë sent in an account of his meteorological observations made at Antwerp in 1869. The following manuscripts were then examined:—A letter from M. G. Boccardo on the fall of a yellowish substance, which occurred at Genes on the 14th of February last. Commissioners, MM. D'Omalius, De Konnick, and Dewalque. (2.) Notes on the Landenian System, by M. J. Moreau. Commissioners, MM. D'Omalius and Dewalque. (3.) On a triangle inscribed in and circumscribed about a conic section, by M. J. Carnoy. Commissioners, MM. Liagre and Folie. (4.) On the natural *puits* of the Coal-beds, by MM. Cornet and Briart. Commissioners, MM. D'Omalius and Dewalque. (5.) On the superficial viscosity of layers of a solution of saponine, by M. G. Vander Mensbrugghe. Commissioners, MM. Plateau and Duprez. Reports on several memoirs were then laid on the table, and appear in full in the *Bulletin*, No. 3.

ROYAL INSTITUTE OF LOMBARDY.

MILAN, MARCH 10TH.—Cavaliere C. Castiglione in the chair.—Signor Porta read a paper on the administration of chloral.

He was followed by Professor Zoncada, who continued his paper from the last meeting on the formation of the Italian tongue from the Latin.

Professor Lemoins gave a further account of his experiments on the extirpation of the cerebellum in the fowl.

A note by Signor Fumagalli was read on the subject of a microphyte found in the substance of a hen-egg.

The Institute then passed to the consideration of literary matters, and to receive the reports of various commissioners.

VIENNA ACADEMY OF SCIENCES.

APRIL 7TH.—Herr Professor Barth sent in a memoir on Kresol isomers.

Herr Tschermak gave an account of his observations on the meteorites which fell at Mooltan, in India, on the 1st of October, 1868.

Herr Gustav Mayr read an account interesting to zoologists of the *Formicidæ* of New Granada.

Dr. Reitlinger read a paper on the subject of spectra of electric discharges through Geissler's tubes.

Herr Professor Biesiadecki read an account of his researches on the formation of epithelium in the skin of frogs.

NOTES AND MEMORANDA.

The Street Tramway Movement.—The two miles and a half length of street tramway has been opened between Whitechapel and Bow Churches. The line is constructed by the North Metropolitan Tramway Company, and the works have been carried out by Messrs. Fisher & Parrish, American contractors, who have successfully supplied Liverpool and Dublin with similar conveniences. Owing to certain sewering operations in South London, the Brixton line is nothing like so perfect an illustration of the system as this in the eastern district. The registered number of passengers is 46. The cars are about double the length of ordinary omnibuses, and are built to seat 22 within, and 24 without. According to the provisions of the Act of Parliament, workmen are to be conveyed at the fare of one penny on particular journeys, morning and evening. The horses wear a minimum of harness—nothing, in fact, behind the collars, and the drivers are clad in the smartest of liveries. The calculation is that one horse on the tramway can do the work of three on the common road. The car is stopped by the break, rapidly applied by the driver. The vehicle is balanced upon indiarubber springs. The Whitechapel undertaking has cost something like £4,000 per mile.

Opening of the University of London.—The new building of the University of London, in Burlington-gardens, was formally opened by her Majesty the Queen on Wednesday last, in the presence of the Prince and Princess of Wales, the Princess Louise, the Chancellor of the University (Earl Granville), the Vice-Chancellor (Mr. Grote), Mr. Gladstone, Mr. Disraeli, the Duke of Devonshire, Mr. Goschen, Sir J. Bowring, General Sabine, President of the Royal Society, the Vice-Chancellor of Oxford, the Presidents of the General Medical Council, of the Royal Colleges of Physicians and Surgeons, and of King's College, and a large number of graduates in the several faculties of the University. Her Majesty, who arrived soon after twelve o'clock, was conducted to the dais in the theatre, and an address, expressing thanks to her for consenting to open the building, was presented to her by Earl Granville. At the conclusion of the address, her Majesty handed

to the Chancellor the following reply:—"I thank you for your loyal address. It gives me great satisfaction to open the beautiful and spacious building provided by the liberality of Parliament for the University of London. The completion of that building marks a new era in the history of the University, the achievements of which have already justified the expectations of the patriotic and enlightened men by whose efforts and on whose advice it was founded. I have never ceased to watch with great interest the growing usefulness of this noble institution; and I do not doubt, and I earnestly desire, that the confidence with which the University is regarded, not in England only, but throughout my empire, will continue to increase; and that its influence will be used in the future, as heretofore, for the encouragement of sound and liberal education among all classes and races of my people, without distinction of creed." Her Majesty then declared the building opened; and the royal party soon afterwards left. The first Convocation in the new building was then held, and the graduates and prizemen were presented.

Preventing Incrustation in Boilers.—The invention of Mr. C. Forster, of Augsburg, Bavaria, consists in placing a vessel above the boiler, and connected to it by two pipes, thus:—To the top of the boiler he bolts a standard, through which are two small pipes. To the upper end of this standard a cock or valve is secured, having two passages through it to open or close the passages from the boiler through the standard to a closed vessel, which vessel he bolts on to the upper side of the cock or valve. This closed vessel, which is secured to the boiler by the standard and valve chamber, has two pipes in it extending upwards from the passages in the valve chamber to about its centre, or a little higher; the passages or pipes at the lower end of the standard are connected to two similar pipes projecting downwards into the boiler reaching below the low-water level. In this manner there is a continuous passage from the boiler to the closed vessel above, as described by means of two distinct pipes and passages, each pipe being open at both ends, but capable of being closed by the valve between the boiler and closed vessel above.

SCIENTIFIC DIARY.

WEDNESDAY, May 18th.

Society of Arts, 8 p.m. "On International Money of Account, independently of International Coinage," by Jacob A. Franklin, auditor of the society; in sequence to his paper "On the Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1855. The chair will be taken by Sir David Salomons, Bart., M.P.
Pharmaceutical Society, 8 p.m.

THURSDAY, 19th.

Royal Society, 8 30 p.m. "Experiments on the Use of Alcohol (Ethyl Alcohol) on the Human Body," by Dr. Parkes, F.R.S., and Count C. Wollowicz. "On the Cause and Theoretic Value of the Resistance of Flexure in Beams Subjected to Transverse Stress," by W. H. Barlow, F.R.S. "On Deep Sea Thermometers," by Commander J. E. Davis, R.N. "On the Difference between a Hand and a Foot, as shown by their Flexor Tendons," by Rev. Dr. Haughton, F.R.S. And other Papers.
Royal Institution, 3 p.m. Electricity, by Professor Tyndall.
London Institution, 7.30 p.m.
Royal Society, 8.30 p.m.
Society of Antiquaries, 8.30 p.m.
Zoological Society, 8.30 p.m.
Chemical Society, 8 p.m.
Numismatic Society, 7 p.m.
Anthropological Society, 8 p.m. "Race in Music," by Henry F. Chorley, Esq.

FRIDAY, 20th.

Philological Society, 8.15 p.m.
Royal Institution, 8 p.m. Atoms, by Prof. Williamson.

SATURDAY, 21st.

Geologists' Association.—Excursion to Erith, Kent. Members to meet at Charing Cross Station, at 2 p.m.
Royal Institution, 3 p.m. Comets, by Prof. Grant.

SUNDAY, 22nd.

Sunday Lecture Society, 8 p.m. "On the ideas of the Ancient Greeks respecting death and immortality," by the Rev. Professor Lewis Campbell, M.A., Oxon. (St. Andrew's University).

MONDAY, 23rd.

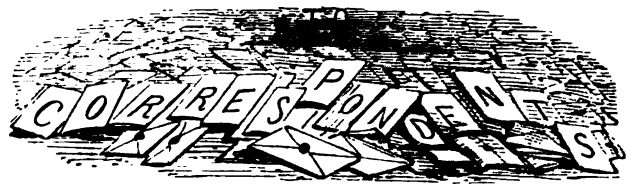
Royal Geographical Society, 8 p.m.
Victoria Institute, 8 p.m.
London Institution, 4 p.m.
National Association for the Promotion of Social Science, 8 p.m. "How to Develop the Passenger Traffic on Railways, exemplified by Special Reference to the Midland Railway," by G. W. Jones, Esq.

TUESDAY, 24th.

Royal Institution, 3 p.m. History, Prof. Seeley.
Royal Medical and Chirurgical Society, 8.30 p.m.
Institution of Civil Engineers, 8 p.m.
Ethnological Society, 8 p.m.
Birmingham Natural History and Microscopical Society, 7 30 p.m. Conversazione and Exhibition of Specimens. Short papers from the Zoological Section, &c.

WEDNESDAY, 25th.

Society of Arts, 8 p.m. The Paper by Mr. Willis, "On the New Organ in the Albert Hall of Arts and Sciences," is postponed.
Geological Society, 8 p.m.
Royal Society of Literature, 8 30 p.m.
Archæological Association, 8 p.m.



SUNDAY LECTURE SOCIETY.—"W. H. D."—You will see that, so far from taking the view you allege, we think very highly of your labours. The omission from the diary was purely accidental, and we regret that it should have occurred.

ENAMEL PHOTOS.—"M. H. Claudet is thanked for his courtesy. We shall be very happy to comply with his request.

NEWCASTLE-ON-TYNE NATURAL HISTORY SOCIETY.—"A. F. M."—We have adopted the suggestion contained in your letter. Glad always to help you in any way we can.

DR. GOERG'S "DICTIONARY OF UNIVERSAL LANGUAGE."—"B. K." is thanked. We have published the announcement sent.

SCIENTIFIC WRITING.—"P. S. W. M."—The letter, we are sorry to say, has been destroyed. It would be impossible to keep pigeon-holes for all our correspondence. We fear our correspondent will not find the task he proposes an easy one. Nothing is more difficult in London.

MANILA CIGARS AND OPIUM.—Our correspondent's communication is in hand.

"THE ENGINEER."—We are extremely obliged to the editor of the *Engineer* for his courteous reply to our letter.

PRINCIPLES OF FLIGHT.—"J. M."—The letter shall appear. We quite agree with you. Why did you not attach your real name and address. We are glad to hear good news from you.

MR. GOSSE'S CORALS.—"W. S. K."—Both your letters have reached us. The communication shall appear in due course.

VICTORIA INSTITUTE.—The letter forwarded to us bears no date, so that it is out of our power to conjecture what meeting is referred to by our correspondent.

INSTITUTION OF CIVIL ENGINEERS.—"J. F."—Your enclosure has reached us, and has been utilised. We have published the announcement as requested. Send us notes for publication in all similar instances.

THE POET-LAUREATE AND ASTRONOMY.—Our constant correspondent "J. C." is thanked for his kindness.

NOTICES.

HOUR OF PUBLICATION.—The Publishing Trade are informed that SCIENTIFIC OPINION will be published at *Mid-day on Wednesday* in future.

Subscribers to SCIENTIFIC OPINION are informed that they can procure of the Publishers direct, or through their local Bookseller, neat cloth Cases for Binding Volumes I. and II. of this periodical, price 2s. each.

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These terms practically abolish the charge for postage, and those of our readers who have hitherto been inconvenienced by the apathy or inattention of their newsagents will henceforth be saved trouble, annoyance, and extra cost in procuring this journal.

THE PUBLISHERS OF SCIENTIFIC OPINION will be happy to forward a prepaid parcel of Prospectuses, &c., to any subscribers who will interest themselves in circulating them among their friends.

WEDNESDAY, MAY 25, 1870.

PRIZES AT THE SCIENTIFIC SOCIETIES.

THERE is a custom prevalent in the French and many other foreign Societies which is seldom observed in this country, but which we think we might adopt with considerable advantage, both to individuals and Science—we allude to the practice of giving annual prizes for the best essay on some particular question proposed by a Society or Academy; or, generally, for the best work in any particular department of Science which has been published during the year. Such a method of rewarding research is not only productive of great benefits to Science in inducing young and enterprising men to toil for the gratification of their ambition, but it also provides pecuniary remuneration for the labour of the needy workers, and, by causing a great many persons to commence the study of science, it brings forth good fruit in the future.

In the case of certain of the medical examining and licensing bodies something similar to the Continental system certainly exists, though it is on a very small scale indeed. But why should not a system which has been found to produce such excellent results abroad be equally profitable at home? We see no reason why it should not. The successful essays, in the cases of competition for the prizes at the Foreign Academies, are said to be *couronnée;* and this in itself is—even apart from the monetary reward—a stimulus to the writer; and if we had something similar in this country, we doubt not the consequence would be beneficial to science.

Why, for instance, should not the Royal Microscopical Society, each year, offer a prize or medal for the best essay on some important and unsolved problem in histology or the principles of the microscope? There are many points still unworked in reference to both these branches; and, we doubt not that, did the Society offer to *couronner* the best essay (its quality being absolutely good) on any selected subject, by affixing to it the stamp of merit, which its seal or medal would surely convey, numerous and able memoirs would be sent in for competition by the microscopists of Great Britain and even of the Continent.

Or, again, consider what excellent results would come of an offer by the Zoological Society to award a medal for the best memoir, say on the anatomy of some type, the knowledge of whose structure is still involved in obscurity. Similarly, in the cases of the Linnæan, Chemical, Astronomical, Geological, and the various other Associations which now exist in London, and, while maintaining an existence, are yet often in want of those scientific communications which such a measure as that proposed by us would certainly lead to.

It is quite possible that there may be certain disadvantages attendant on such a scheme as that which we propose; but we fancy that, even if they be admitted, they must be small indeed compared with the benefits. Some may urge that it would stimulate men to work for lucre rather than for love; and this may be true in particular instances. On the other hand, it may be asked if it is not well to make men work at Science, even for a love of gain; especially as the temptation is so very small, and every additional follower of Science is so certain to contribute his stone to the great heap which the labours of each year accumulate?

At all events, whatever may be the merits or demerits of the plan so popular in Continental academies, there can, we think, be little doubt that the idea is one worthy of consideration by those who rule our scientific societies at home. And we trust that, now we have thrown it out, some of those who have energy and enterprise in the councils of the London scientific societies will take the matter up, and develop it in the proper direction.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

MR. GLEDHILL, of Mr. Crossley's Observatory, Halifax, has commenced a series of measurements of the white cloud and small crater of Linne, so celebrated as the only authentic instance of change on the moon's surface. The few measures obtained during the present lunation indicate a similar variation in the extent of the white cloud to that recorded by Mr. Birt, in the *Report of the British Association for the Advancement of Science for the Year* 1867. The object presents as nearly as possible the same aspect as in 1867, viz., a minute crater, the orifice not exceeding one second in diameter. Generally from about twenty-four to forty-eight hours after sunrise upon it the white cloud is seen surrounding it.

AT the annual meeting of the Royal Geographical Society the day before yesterday, it was announced that the Government had made a further grant of £1,000 on account of Dr. Livingstone's expedition. The King of the Belgians, who was present, was elected a member.

THE *Lancet* says that MM. *Auguste Waller* and Prevost state that in repeating the principal experiments of the late Professor Rosenthal, on the effects produced on respiration by electrifying the superior laryngeal and pneumogastric nerves, they were struck by the occurrence of certain movements of ascent of the larynx in mass exhibited when the superior laryngeal nerve was stimulated. They soon ascertained that these were really movements of deglutition of a reflex nature, and they were induced to study the subject more carefully. Dr. Augustus Waller, formerly Professor of Physiology in Queen's College, Birmingham, has been so long out of England, that even the *Lancet* may be pardoned for thus speaking of him as *M. Auguste* Waller, though the mistake, to those who know Dr. Waller, is somewhat amusing.

THE names of the Commissioners on State Aid to Science are the following:—The Duke of Devonshire, the Marquis of Lansdowne, Sir John Lubbock, Sir James Phillips Kay Shuttleworth, Mr. Bernhard Samuelson, Dr. William Sharpey, Professor Huxley, Professor Miller, and Professor Stokes.

DR. CAYLEY has left Simla, in order to make his final preparations for the march to Ladak. His main duty this year will be to lay out the new trade route by the Chang Chemmoo valley, through the territories of the Maharajah of Cashmere. In this work he will have associated with him Bukshee Ram, a high official of the Durbar.

PROFESSOR HUXLEY distributed the prizes to the University College medical students on Wednesday, and delivered an address to the audience. In remarking on medical education, he said that he had been struck with the singular unreality of the knowledge which the students displayed on the subject of physiology. His complaint was that they did not know physiology as they knew anatomy, which was taught as a science ought to be taught. On the contrary, physiology was imparted to them as a mere matter of books and of hearsay. Referring to the absurd custom of making students know all about the botany, chemistry, and preparation of drugs, Professor Huxley said that they might as rationally be expected to know the mystery of cutlery because they employed knives.

WITH regard to the International Congress of Prehistoric Archæology, to which we referred the week before last, we beg

to state that Mr. John Evans has consented to receive the subscriptions of English members, which may be addressed to him at 65, Old Bailey, E.C. The subscription is fixed at 10s., and entitles a member to be present at all the meetings and to receive the publications for the year.

On Wednesday evening last a *conversasione* was given at the South Kensington Museum by the Pharmaceutical Society of Great Britain, by permission of the Lords of the Committee of Council on Education. On former occasions the *soirées* of the Pharmaceutical Society have been held at the Society's house in Bloomsbury-square, and objects of pharmaceutical interest have been exhibited to the members and visitors. On Wednesday, however, there was no exhibition of this kind, and the only object of the society was to entertain the friends of the members. The band of the 1st Life Guards, under Mr. D. Godfrey, performed at intervals during the evening, and a selection of glees, by the members of the Orpheus Club, attracted large numbers of visitors to the lecture theatre. Tea and coffee were served in the refreshment-rooms. It is said that 5,000 invitations were issued, and the building was well, but never inconveniently, filled. A considerable number of the leading physicians and surgeons of London were among the company, which did not separate until a late hour.

Captain Ericsson announces, in a communication to the American *Army and Navy Journal*, that he has perfected the system of submarine attack by which he can destroy the largest ironclads ever built. The resistance of the water is so great that explosive projectiles have always proved failures hitherto when designed to strike below the water-line. Captain Ericsson is confident that he has devised a projectile which will overcome the difficulty caused by this resistance. It is an elongated shell, charged with 300 lb. of dynamite, and shot from a 15-inch gun at such an elevation as to enter the water near the hostile vessel, and strike the hull anywhere below the water-line. It is fitted with a percussion cap, which explodes upon very slight impact against the hull, so that the velocity of the shell when it reaches its destination need not be high. The gun is carried on a swift armoured boat, protected by a turret. Captain Ericsson intends to make a formal offer to test this invention. He is ready to fit out at his own cost and risk a fast screw vessel with two 15-inch guns of the kind described, if somebody else will furnish the ironclad to be experimented upon. In the politest terms he does this country the honour to single out the new British ironclad *Devastation* as one of the most splendid specimens of an armoured war vessel which can be produced, and challenges her to come out and encounter his torpedo.

The Committee of the House of Commons has given its decision upon a Bill, the progress of which has been looked to with much interest, and which, if passed into law, will effect a wonderful change in the mode of communication between this country and the Continent. The Bill is entitled "The International Communication Bill," and embodies Mr. Fowler's scheme for establishing a service of railway steam-vessels between Dover and Andrecelles, which is a short distance from Boulogne. Both at Dover and Andrecelles, harbours for the accommodation of the vessels, which will resemble floating castles, are proposed to be built. The end of a short line connecting both harbours with the railway would form an hydraulic lift, by means of which a train of twelve carriages could be run on the upper, and twelve on to the lower deck of the vessel, which would be 420 ft. long and of 1,600 horse power. Thus, passengers booking at Paris or London could accomplish the whole journey without leaving the carriages. The steamer would pass so smoothly over the roughest sea that the present inconveniences of the voyage would be removed, and the average weight of the proposed trains would be so light as to admit of no difficulty in carrying them across the Channel at a rate of om 20 to 25 miles an hour. Mr. Fowler estimates the cost of a harbour at £700,000, and of the vessels at £120,000. At Dover the work will be carried out by private persons, under the authority of the Bill, and Baron Alphonse de Rothschild, the President of the Northern Railway of France, has engaged the French Government to build the harbour at Andrecelles. The capital is to be fixed at £200,000 for both sides. It was stated in the course of the evidence that the Emperor of the French was favourable to the project. The Committee has decided that the preamble of the Bill was proved, subject to the introduction of provisions reserving the powers of the Boards of Admiralty and Works.

The next meeting of the Photographic Society will be held on Tuesday, 14th June, 1870, at eight o'clock, after which the meetings of the society will be discontinued during the recess, and recommenced with the opening of the usual winter exhibition of photographs on the evening of Tuesday, 8th November, in the same place.

Collectors and possessors of fresh-water shells may be interested in knowing that such conchological specimens are wanted—either as exchange or for purchase—from *all parts* of the world, by Mr. Charles M. Wheatley, of *Phœnixville, Pennsylvania*, U.S.

An American dentist has written a paper to prove that nearly all the "ills that flesh is heir to" come of eating common salt, He says:—"While I would not wish to be understood as believing that common salt is the sole cause, I *do* believe that it is *one* of the giant evils that are tending so remarkedly to undermine the health of man, and, with the health, the mind."

The following university notes reach us from America:—Dr. H. L. Hodge, jun., has been appointed Demonstrator of Anatomy in the University of Pennsylvania, *vice* Dr. D. H. Agnew, who has resigned, and has been invited to the chair of Clinical and Operative Surgery, just created. Professor Nathan R. Smith has resigned the chair of Surgery in the University of Maryland, which he has filled with great ability for the past forty years.

The *British Medical Journal* says that Dr. Lorinser, of Vienna, gives, in the *Wiener Medizinische Wochenschrift* for May 14th, the results of a number of observations made regarding the effect of a new remedy for intermittent fever. The remedy is the tincture of the leaves of the *Eucalyptus globulus*, a plant of the natural order *Myrtaceæ*. In 1869 Dr. Lorinser made some experiments, the results of which he published; but he was brought to a standstill by the want of a supply of the medicine. The plant has since been cultivated by Herr Lamatsch, an apothecary; and a sufficient quantity of tincture has been made from the leaves to supply a number of medical men in the districts of the Theiss and the Danube, and in the Banat. The records of fifty-three cases of intermittent fever in which the Eucalyptus was administered have been communicated to Dr. Lorinser.

Our ably-conducted contemporary, the *Engineer*, gives, in its last number, an excellent biographical sketch of the late Zerah Colburn, a gentleman well known to students, both of practical and theoretical dynamics for a series of interesting works on these subjects. The *Engineer* says:—"It seldom falls to the lot of the journalist to discharge a sadder duty than that which we have to perform to-day in announcing the death of an engineer for several years connected with this paper, and whose name will be familiar to each one of our readers. On the 25th of April, Zerah Colburn was found lying in an orchard at Belmont, near Boston, U.S., whither he had wandered a day or two before from New York, mortally wounded in the head by a pistol-shot fired by his own hand. Not yet dead, though dying, he was borne to the county hospital, where he expired a few hours afterwards. In this way has passed from amongst us an engineer whose abilities were sufficient, had they been but wisely directed, to raise him to any position that a member of

the profession can reasonably hope to attain. Of the causes that led him to commit suicide it is not our place to speak.

The first number of the *Annales des Mines* for the present year contains an able and instructive paper by MM. Delesse and De Lapparent, on the progress of and the discoveries made in geology during the past ten years. We commend the paper to the notice of our readers.

The Roman Circus, in Paris, the discovery of which was recently described, is to be purchased by the Municipal Council of Paris, with all the interesting relics, the nation and the city each supplying the sum of 600,000f.

Mr. John Gay, at the last meeting of the Council of the College of Surgeons, gave notice of his intention, at the next meeting, to move the following resolution:—"That, in the opinion of this Council, provision should be made in the Medical Act (1858) Amendment Bill, now under the consideration of the Legislature, for the *direct* representation of the Fellows and Members of the Royal College of Surgeons of England in the General Medical Council of Education and Registration of the United Kingdom, and that a copy of this resolution be forwarded to the Lord President of the Privy Council.

The Council of the Society of Arts, last July, offered the silver medal of the Society for the best treatise on the profitable production of tea. Competing treatises must be sent in to the Secretary of the Society of Arts, on or before June 1st, 1870. Each treatise must bear a distinguishing motto, and be accompanied by a sealed envelope, containing the name and address of the writer, with a corresponding motto on the outside.

The Cross of the Crown of Italy has been conferred on Dr. Fernando Verardini for his valuable contributions to the medical literature of Italy.

We understand that there is at last a prospect of the vast mineral wealth of China being turned to some account. Tring Footæ has received permission to open up the coal-fields at Nanking and Kinthaing, where coal of a very superior quality is obtainable. He intends to send to England for competent engineers and the requisite machinery. Good specimens of coal have also been obtained at San-ti, some two hundred miles above Hankow.

It is reported that M. Sauer, a surgeon-dentist of Berlin, after having performed various comparative experiments with anæsthetic substances, has come to the conclusion that the very best is a mixture of protoxide of nitrogen, chloroform, and atmospheric air. He considers this compound to be free from the dangers attendant on the use of either chloroform or the protoxide alone. The proportions which he advocates and employs are the following:—Liquid chloroform, six grammes; atmospheric air, three-quarters of a litre; and protoxide of nitrogen, sixteen litres.

Dr. Michael Foster, the eminent Professor of Practical Physiology in University College, and one of the secretaries to the Biological section of the British Association, has been elected Prælector in Physiology at Trinity College, Cambridge.

Dr. Farr proposes to substitute for the present sovereign a new gold coin of the value of twenty-five shillings, weighing 10 grammes (the weight of the sovereign being 8 grammes), and to be called a "Victoria." Of this new coin Dr. Farr says,—"It will be a new guinea—a guinea amplified, beautified, and decimally divisible into convenient subordinate units." The principle involved in this standard of value has been adopted by Dr. Farr from the French economist M. Chevalier, and it is the obviously correct one of making current coins represent simple weights of the precious metals.

A correspondent asserts, in the [American] Rutland *Herald*, that the great fossil mastodon, discovered in 1866, and now preserved in the New York State Geological Museum at Albany, is not a mastodon after all. His story is that a Mr. William Bradley, in the year 1830, was following an elephant belonging to a menagerie one night, when the animal fell dead. Bradley and the keeper, after cutting the tusks off, sawed the rest of the body in pieces, and buried the remains in holes which they dug in the vicinity. And he asserts that it was these remains which were discovered in 1866!! This is too absurd for credence.

The executive of the American National Photographic Association are making arrangements for an annual meeting and exhibition at Cleveland, Ohio, which promise to possess unusual excellence.

The lectures for the present year at the College of Surgeons will be resumed on Monday next, by Professor Birkett, F.R.C.S., who will deliver six lectures on "The Nature and Treatment of New Growths." Mr. Hulke, F.R.S., will afterwards give three lectures on "The Minute Anatomy of the Eye," in continuation of his course of last year. The lectures will be delivered in the theatre of the College on each Monday, Wednesday, and Friday, at four o'clock, until completed.

The Academy of Sciences has, says the *Lancet*, awarded a prize of the value of about £100 to MM. Paulet and Jules Sarazin for their grand treatise and atlas of surgical anatomy. The award is as honourable to the givers as to the receivers. It is the spontaneous recognition of a work showing more labour and artistic accomplishment than most works published in our time. The French societies, in this principle of voluntarily awarding prizes for great books published voluntarily by their authors, set an example which, the *Lancet* very justly remarks, our societies would do well to imitate.

The Council of the Society of Arts have appointed a Committee to "report whether there is good foundation for the statement that reasonable dissatisfaction exists respecting the manner in which inventions are examined and dealt with by Government, and, if such be the case, whether any practical remedy can be suggested;" and the following gentlemen have consented to serve upon it:—F. J. Bramwell; Hyde Clarke; Henry Cole, C.B.; Warren de la Rue, F.R.S.; Major Dyer, R.A.: Captain Donelly, R.E.; John Fowler; Lord Richard Grosvenor, M.P.; Admiral Halsted, R.N.; Thomas Hawksley; Admiral Sir J. D. Hay, Bart., M.P.; C. W. Merrifield, F.R.S.; Professor W. A. Miller, F.R.S.; John Penn; J. Ramsbottom; Alderman Sir W. Rose, Bart., Admiral Ryder, R.N.; Captain Scott, R.N.; C. W. Siemens, F.R.S.; Captain Tyler; Thomas Webster, Q.C., F.R.S.; Sir Joseph Whitworth, Bart., F.R.S.

The American Medical Association is holding a Congress at Washington. The principal business before it relates to three subjects: the recognition of female doctors; the recognition of coloured doctors; and medical education. The female and coloured delegates have been excluded.

Besides the candidates already mentioned for the chair of Midwifery in the University of Edinburgh, we now hear of others, whose chances, however, are small compared with those of Dr. Duncan. Dr. Keiller, an obstetric physician of great experience and much acceptance as a lecturer, has announced his intention to contest the vacant professorship; while Dr. Alexander Simpson (a nephew of Sir James), and Dr. Coghill, are also expected to submit their claims to the curators.

Last Wednesday Prof. W. A. Miller delivered the Reade Lecture for this year in the University Senate House to a numerous audience. The lecture was "On some chemical processes of forming Organic Compounds, with illustrations from the Coal-tar Colours."

The apparatus used in the recent boring experiment at Middlesborough-on-Tees, and which resulted in the discovery of important salt beds, was that invented by Mather and Platt, of

Salford Ironworks, Manchester, in which the boring-tool is attached to a flat rope, and by percussive action loosens the earth or rock, when, giving place to a peculiar kind of bucket which fills itself, the fragments are drawn up. This alternation is continued till the required depth is reached. By the use of the rope the work is greatly facilitated, for everything can be raised or lowered with rapidity, thereby contrasting favourably with the slow progress that attends the use of iron rods. The boring at Middlesborough, 1,312 ft. deep and 18 in. diameter, was accomplished in 540 days, including 150 days of stoppages, mostly for the purpose of pumping out and testing the water accumulated in the well. Deducting these, the sinking occupied not more than 300 days; and it is worth notice that the number of men employed never exceeded six.

Under the title of "Maryland Academy of Sciences," is announced the organization of a Natural History Society in the city of Baltimore, U.S. Its fifty members have already secured proper apartments, centrally located, and received donations of collections of books and specimens, and begun the regular scientific work of the society. The basis of the new Academy, as announced in article two of the circular which the Academy has issued, is broad and effective, and ought to insure its members the moral and material support of the community which is to be benefited by the labour of its members. As stated in this article, "its object shall be to promote scientific research, and to collect, preserve, and diffuse information relating to the sciences, *especially those connected with the natural history of Maryland.* The officers of the Academy are Philip T. Tyson, president; John G. Morris, D.D., vice-president; Edwin A. Dalrymple, D.D., corresponding secretary; Charles C. Bombaugh, M.D., recording secretary; John W. Lee, treasurer; P. R. Uhler, curator; A. Snowden Piggott, M.D., librarian; J. B. Uhler, J. De Rosset, M.D., and F. E. Chatard, jr., M.D., assistant curators.

The annual meeting of the Royal Agricultural Society was held on Monday, Lord Walsingham in the chair. The exhibition in July next is to be held at Oxford. The report stated that the Society had been invited to take part in an International Agricultural Congress next year in Paris. Lord Vernon was elected president for the ensuing year, and the Council was strengthened by the accession of Mr. Charles Whitehead, an eminent agriculturist of West Kent.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

ON THE ANCIENT IRON TRADE OF IRELAND.

BY G. H. KINAHAN, M.R.I.A., ETC.

In Three Parts.—Part I.

ABOUT two hundred years ago there was a large trade in the manufacture of iron in Ireland; of the extent or former existence of this trade very little, however, seems now to be known.[1]

That the manufacture of iron was practised by the Irish Celts would appear probable, as different implements made of that metal are found in their ancient habitations; nevertheless, no distinct mention or record of the iron-workings would appear to have been made or kept until after Queen Elizabeth's reign, when the Saxon emigrants and settlers gave an importance to the trade and largely developed it.

Among the different Englishmen who, in former years, wrote about Ireland, none have entered so largely into its natural history as Dr. Gerard Boate.[2] This author seems to have been best acquainted with the iron mines and works in Leinster, Ulster, and Munster; however, as will be seen by the sequel, there were also extensive works in Connaught. Another author (Smith[3]), who wrote in 1750, mentions the iron mines and works in the co. Cork.

Dr. Boate asserts it was in the latter years of the reign of Queen Elizabeth that the great trade in iron sprang up, for he thus writes:—"Whereas there never was an ironwork in Ireland before, there hath been a very great number of them erected since the last great peace in sundry parts of the provinces." The peace he herein mentions is thus described:—"This last great peace of about forty years," after the great rebellion of the Irish, "who were overthrown in the last years of Queen Elizabeth by her viceroy, Sir Charles Blunt, Lord Mountjoy, and afterwards Earl of Devonshire." This Lord Mountjoy seems to have been viceroy over the Irish in the years 1600 to 1604.

An epitome of Boate's iron ores is as follows:—*There* are three kinds; the first "is drawn out of moors and bogs," and called *bog-mine;* the second "is hewen out of rocks, and is called *rock-mine;* while the third "is digged out of mountains," and has "several names—*white-mine, pin-mine,* and *shell-mine.*" "Bog-oar is very rich of metal, and that very good and tough; nevertheless, in the melting it must be mingled with some of the mine or oar of some of the other sorts; for, else, it is too harsh; and, keeping the furnace too hot, it melteth too suddenly and stoppeth the mouth of the furnace, or, to use the workman's own expression, choaketh the furnace." "The rock-mine is not altogether so rich as the bog-mine, and yieldeth very brittle iron, hardly fit for anything else but to make plow-shares of it [from whence the name of colt-share-iron is given unto it], and therefore it is seldom melted alone, but mixed with the first of the third sort."

Of the third sort, the veins or ridges are vulgarly called "pins," from whence the mine hath the name of pin-mine, being also called white-mine, because of its whitish colour; and shell-mine, for it is composed of shells or scales, the which do lye one upon another. Within every one of these lumps, when the mine is very rich and of the best sort (for all the oar of this kind is not of equal goodness; some yield more and better iron than others), lieth a small kernal, which hath the name of honeycomb given to it, because it is full of little holes, in the same manner as that substance. The iron coming of this oar is not brittle, as that of the rock-mine, but tough, and in many places as good as the Spanish iron."

The first ore mentioned is the earthy or impure *limonite*, that occurs in vast quantities in many places in Ireland as a recent surface deposit, being formed by secondary action from the decay or decomposition of the bisulphides of iron, but principally from that of marcasite, so prevalent as a constituent in many of the rock masses, both derivate and ingenite. The second is either hydrous or anhydrous peroxides of iron (limonite or hematite), generally occurring in true lodes; while the third is the different varieties of clay-ironstone, an impure or earthy variety of siderite, occurring in beds interstratified with the derivate rocks of the coal-measures. This is quite evident, from the author's subsequent description, for he thus writes:—"The first sort, as the name doth show, is found in low and boggy places, out of which it is raised with very little charge, as lying not deep at all, commonly on the superficies of the earth, and about a foot in thickness." Of the second:—"Of this kind, hitherto, there hath but two mines been discovered in Ireland; the one in Munster, near the town of

[1] In a book only a short time since published (the translation and enlargement of Simonisi's *Underground Life*, by H. W. Bristow, F.R.S., &c.), although the early iron trade in England is mentioned, yet that of Ireland is quite ignored.

[2] *The Natural History of Ireland.* By Gerard Boate, late Doctor of Physick to the State in Ireland. This history was republished at the "Two Bibles," in Essex-street, 1726, by George Greirson. The exact date of the first edition of Dr. Boate's book is uncertain. However, it must have been about the year 1645, as it was written immediately after the rebellion of the Irish in the reign of Charles I.

[3] *History of the County Cork.*

Tallow, by the Earl of Cork's ironworks; and the other in Leinster, in King's county, in a place called Desart land." The first of these appears to be a hematite, while the latter, according to Apjohn's analysis, is a limonite.[4]

Over ten places, in which the third variety was known to exist, are mentioned by this author, all occurring in the coal-measures; and from his description of the ore, and the mode of work, it is quite evident it must be one of the varieties of clay-iron-stone.

The ores were melted by wood charcoal; part in furnaces, the rest in bloomeries. The furnaces are thus described:—"At the end of a great barn standeth a large furnace, being of the height of a pike and a half, or more, and four-square in figure, but after the manner of a malt-kiln—that is, narrow below and by degrees growing wider towards the top, so as the compass of the mouth, or the top, is of many fathoms." The "blast" was kept up by "two vast pair of bellows, the which, resting upon main pieces of timber, and with their pipes placed into one of the sides of the furnace, are perpetually kept in action by the means of a great wheel, which being driven about by a little brook or watercourse, maketh them rise and fall by turns, so that, whilst the one pair of bellows doth swell and fill itself with wind, the other doth blow the same forth into the furnace." The bloomery "is another and lessor sort of ironworks, much differing from the former, for instead of a furnace they use a hearth therein, altogether of the fashion of a smith's hearth, whereon the oar being laid in a great heap, it is covered over with abundance of charcoal, the which, being kindled, is continually blown by bellows that are moved by wheels and watercourses, in the same manner as in the other works." The works mentioned by this author are "in divers places in Munster, by the Earl of Cork; in the counties of Roscommon and Leitrim; also at Montrath, in the Queen's county, by Sir Charles Coot; at Ballinakell, in the latter county, by the Earl of Londonderry; at Mountmellick, in King's county, by the Viscount of Ely; in Fermanagh, by Sir John Dunbar; another in the same county by the side of Lough Earn, by Sir Leonard Blenerhasset; and in the county Tomond (Clare) by some London merchants." Smith says of those in the county of Cork, "There are two considerable ironworks carried on, as it were in both extremities of the county, viz., Comoly (Coomhoola), near Bantry Bay, for both sow and bar iron; and in the parish of Affadown (Aghadown), near Roaringwater Bay, for sow iron only; and also at Aragline, near the eastern extremity of the county; in all which places iron-ore is found in plenty."

The localities in Tomond are not enumerated by Dr. Boate; however, the following have been observed in the old county of Clare, or the Tomond, in the days when this author lived. Southward of the village of Scariff, in the townlands of Ballymalone and Bealkelly, there are the remains of extensive "old-mens-workings" for iron, on what are either beds or veins of limonite with some hematite, in black Silurian shales. In the first townland, in addition to the workings, are the ruins of an old iron furnace; while, in Bealkelly, besides the ruins of a furnace, there is also the remains of a mill for manufacturing bar-iron. Those in the last-named townland are said to have belonged to a family of the name of Brady, who were granted the Royal manor of Raheen, to which this townland belonged. In this neighbourhood, besides the works already mentioned, there was a large iron mill at Coolcoosaun, one mile north of Scariff, and a furnace at a hamlet that is now called after it, nearly a mile east of Feakle Church. In the latter furnace bog-iron ore mixed with "red mine" (the hydrous or anhydrous bioxide) seem to have been smelted, as fragments of all these kinds of ores were observed among the heaps of *débris* in the vicinity of the old furnace. Moreover, old burrows for the last-named ore were observed on the hill to the northward, and for bog-iron ore in the flats and bogs southward of Lough Graney. Red-mine is said to have been extracted a little further N.W. in the north part of Glendree, where an old adit that was driven into the hill still exists; however, all the ore raised here may have been smelted in the vicinity, as by a neighbouring stream large quantities of slag were observed. East of Scariff, at a village also called Furnace, near Whitegate, about two miles eastward of Mount Shannon, there was another furnace, and in its vicinity at Meelick there was an iron mill. These two latter localities now are in the present county of Galway.

[4] *Memoirs Geol. Survey of Ireland*, Ex. sheet, 128.

ON OZONE AND ANTOZONE.

BY R. H. ALLNATT, M.D.

IN TWO PARTS.—PART II.

BUT even supposing that Schönbein had not succeeded, let us see what result had attended the well-directed efforts of another known German experimenter, who appears to have met with remarkable success:—

In 1863 Dr. Meissner, of Hanover, published a small work entitled *Untersuchungen über den Sauerstoff*, in which he states that he had succeeded in isolating artificial antozone, and he describes it as a substance possessed of such remarkable properties as left no doubt on his own mind that it plays a very important part in the varying conditions of the atmosphere. His method of obtaining it was by electrifying a perfectly dry stream of oxygen gas, and afterwards depriving it of its ozone by a solution of iodide of potassium. The gas thus prepared has the remarkable property of forming, in contact with moisture, dense clouds, the aqueous vapour becoming condensed in the form of little vesicles or hollow spheres, which remain suspended and constitute the cloud. According to Meissner, this result is due to the great attraction of antozone for water, and leads further to the formation of peroxide of hydrogen, wherein is contained the second atom of oxygen in the state of antozone. He considers every cloud of our atmosphere antozonic, that is, formed under the direct influence of antozone; in support of which view he adduces the curious fact that clouds can only be formed in gases which contain oxygen. If aqueous vapour be condensed in gases which are free from oxygen, or in a vessel which contains beside water no other gas, the condensation never takes place in the form of a cloud, but in that of little solid globules, which, by reason of their greater specific gravity, instantly subside.

Our author endeavours to prove that antozone is formed naturally wherever ozone exists, but the presence of antozone is more difficult to prove than that of ozone, owing to a singular property of antozone which Meissner calls "abklingen," or want of persistence, for, when left to itself, it speedily loses its specific characteristics and becomes converted into ordinary oxygen. Its peculiar and important properties are due to its molecules being charged with free positive electricity. Meissner considers antozone, therefore, to be the binding medium—the receiver and retainer—of atmospheric electricity.

These important facts, so minutely detailed by Meissner, have yet to be fully verified by experimenters, and, should they prove to be legitimate deductions, they will be a great step in advancing the progress of meteorology. Dr. Meissner's work deserves to be more generally known, and a free translation from the German would be an acceptable boon to the English student. The want of persistence of which he complains had been the chief obstacle with Schönbein and other observers to the obtaining a definite result when experimenting with so evanescent a body as that of the peroxide of hydrogen.

The presence of atmospheric ozone is tested by means of a delicate reagent. Pure white bibulous paper, saturated with a solution of iodide of potassium and starch, is cut into slips of about 3 in. in length and ½ in. in width, and exposed to the influence of the external air for twelve or twenty-four hours,

day and night, in a situation sheltered from the rays of the sun, direct or reflected. The quantity is ascertained by an ozonometer of varying shades of violet. To determine the precise degree on the scale, a prepared slip, called an ozonoscope, after having been suspended in free air, is dipped in cold water. The extent of coloration thus elicited by the saturation of moisture is compared with the ozonometer, and the result registered.

Schönbein used a chromatic scale of 10°. The French employ a graduation of 12°; but, as you see here, even 10° give too ready a blending, so that the individual tints are so indeterminate as to be read off with some difficulty. I have suggested to the instrument-maker a scale of 8°, as being quite efficient for all useful purposes, and easier for the student than the old scales. A practised observer needs no scale at all; his eye will discern with the utmost accuracy the precise hue of his coloured test.

I will now give a brief practical lesson to those who wish to become useful observers. In January, 1865, the following observations appeared in one of my reports:—

"One of the peculiarities of the antozonides is that they restore that which has been rendered blue by ozone to its white or colourless condition, and this is effected in the following manner:—When two ozonides, or two antozonides, are blended by the addition of water, or an indifferent acid, they mingle, but do not act on each other; but if one body from each adverse list be associated in like manner they mutually act, oxygen is evolved from both, and ordinary oxygen is set free; or rather, ozone separates from one body and antozone from the other, and these uniting, produce the intermediate, or neutral oxygen.

"As Schönbein's views," says Professor Faraday (to whose kindness I am indebted for the foregoing sketch), "include the idea that oxygen in these two states can retain its peculiar properties when out of combination and have them conferred otherwise than by combination, and as ozone does fulfil these and does exist in the independent state, so it is important that antozone should be pursued by experiment until it gives a like result."

Now, the question is, does antozone exist as a natural elemental condition; and, if so, what are the indications of its presence? The 17th, 18th, 19th, and 21st of the present month (January, 1865) where periods when no ozone was manifested; when the test-slips were not only not discoloured, but when those which had previously coloured by exposure to the atmosphere were deprived of their coloration and rendered of a hue nearly approaching their primitive white.

On the 22nd, the day-slips exhibited the maximum, or 10°, of the ozonometer, and during the ensuing night, which was a period of antozone—clear, calm, with frosty North wind—their colour was discharged fully 6°, and consequently the morning register had dwindled down to 4° of the scale. So that, after exhibiting on the previous evening 10°, the ozonoscopes were thrown back, by the antithetical condition of the atmosphere, through considerably more than half the scale.

Whence then this peculiar condition, and these direct manifestations? Does there exist positive atmospheric antozone and have we the means of detecting it?

Well, in answer to this direct appeal, I received a letter from Dr. Moffat, of Hawarden, Cheshire, one of the most experienced ozonographers perhaps in England, in which he told me that he had noticed the fact of the bleaching of tests, but he ascribed it to the influence of sulphuretted hydrogen. In the mephitic atmosphere of crowded cities, or in malarious localities, this might be; but on the high ground of Frant, whence my observations dated, the supposition could not apply, as the altitude was beyond that of Beachy Head. No other theory that I have heard of can square with the observed facts so accurately as that the discoloration is due to elemental antozone.

But to make assurance, as I thought, doubly sure, I wrote, some time ago, to Professor Tyndall, of the Royal Institution. My question was this:—"Schönbein believed that ozone could not exist without the production of its antagonistic congener antozone. When ozone-tests, fully coloured to their maximum hue, become blanched by exposure to the air, is the bleaching to be ascribed to the action of elemental antozone?"

Professor Tyndall replied as follows:—

"Dear Sir,—The answer to your question regarding the action of ozone and antozone is brief, but full. It is thus:—I do not know; nor do I believe that anybody knows.

"Yours very faithfully, JOHN TYNDALL."

I must say, ladies and gentlemen, that this came upon me as a regular knock-down blow, for I had fondly hoped that a philosopher who had probed the mysteries of the atmosphere would have yielded some *kudos* to the discovery of his fellow-labourer, Schönbein, and to the corroborative testimony of his illustrious predecessor, Faraday. However, we must make the best of a bad matter, and resign ourselves patiently to take upon credit the facts which nature herself appears to teach.

And what are those facts? Look at these *chemical test* papers, prepared with the iodide of potassium and starch. They were all coloured by exposure to the air. What coloured them? Schönbein says ozone; Faraday says ozone; and all the meteorologists of the present day say ozone. And they say so because they know that the ozone will combine with the potassium, set free the iodine, and form an iodide of starch.

Now, let these coloured tests hang in the air, and place by their side a virgin slip, pure and colourless, perfectly white. What will happen? A condition of atmosphere presently occurs when all the slips will become as pure and colourless as the uncoloured test slip by their side. What discoloured these ozonoscopes? I say a period of elemental antozone. Dr. Moffat says a period of elemental sulphuretted hydrogen. Professor Tyndall says, "Nobody knows." Who shall *decide* when doctors disagree? Well, there is some consolation even in this. It gives us all something to find out; something to think about, at any rate.

I must here say, however, that this morning my friend, Mr. Muller, by his very able manipulations, has demonstrated that both sulphuretted hydrogen and the fumes of ammoniacal vapour, in their concentrated form, are capable of bleaching the coloured test slips. But these substances, in such a concentrated condition are, of course, never found to exist in the atmosphere.

With regard to the important question as to the manifestation of ozone in dwelling-houses. The early authors, amid the excitement of dealing with a new and strange discovery, which, in their estimation, invaded the very balance of the atmospherical relations, believed that ozone was invariably absent from inhabited dwellings. We now know that, if free ventilation be permitted, a succession of air laden with ozone will be carried throughout every part of the interior; and every nook and corner will be subjected to its purifying influence. As regards the mephitic wards of public hospitals, ozone has such an aptitude for seizing upon and destroying pestilential miasmata, or the germ-matters of contagion, that it is itself destroyed in completing its work of destruction. This fact I pointed out several years ago in relation to the comparatively limited self-purifying power of the Thames in and about London. In well-appointed private houses, if due regard be paid to thorough ventilation, the presence of ozone will be abundantly manifested; but if, on the contrary, the casements be hermetically sealed, we may look in vain for any trace of the sanitary influence of ozone.

During my stay at Eastbourne in 1866, under the old system of drainage, ozone was very scantily developed. On turning back to my notes of that period, I find that on many days the tests manifested scarcely any signs of discoloration, and twice only attained the maximum of 10°. The minimum, or 1°, existed on seven days; and two days were periods of antozone.

Last February, on the contrary, there were ten periods of maximum development, and the minimum of 3° was reached only on three days; and instead of an ultimate mean a little above 4° (which happened in 1866), we have for last February an aggregate average little short of 8°, or twice the quantity of ozone that was manifested under the old system. These are facts, and are, I think, sufficiently suggestive.

It is much to be regretted that, of late years, this interesting and important subject has been prosecuted with so little vigour and success; for since Schönbein's death it seems to have been completely shelved. Notwithstanding that a committee of inquiry was appointed some years ago, by the Academy of Sciences at Paris, and in England some members of the Meteorological Society were nominated, and told off to act also as a committee of investigation, not a single note has issued from either body in earnest of its very existence. Our chemists appear to be asleep at their posts, and if it were not for a few private investigators, the whole matter would, I very believe, die out and be forgotten.

Even now, much apprehension exists as to the mode of interpreting the signs of the test slips. In making successful observations it must be borne in mind that a period of no ozone is a very different thing from a period of antozone, as shown by the varying influence on the coloured ozonoscopes. In the mere negative condition or absence of ozone, no appreciable action is excited, but elemental antozone produces reaction frequently so powerful as in a few hours to bleach a test-slip of maximum discoloration. Hence the necessity, for the sake of comparison, of always suspending, side by side with the original test, a coloured ozonoscope of ascertained intensity; and of the exercise, also, of unwearied vigilance in recording the results.

Ladies! I have a little secret to whisper to you, alone, and I hope the gentlemen will do me the favour not to listen. In conjunction with the sun, ozone acts as a terrible tanner! The complexion is really influenced by exposure to an atmosphere laden with ozone. There were two days last season, at this place, when the heat was oppressive, and the "human face divine" was literally bronzed by the combined action. But the effects were evanescent, and soon yielded to the "Kalydor" of a mitigated temperature.

In conclusion, the important consideration of the influence of ozone on the human constitution, in relation to health and disease, may be gathered from the physiological effects which follow a superabundance of stimulation on the one hand, and the withdrawal of a healthy stimulus on the other. If ozone be in excess, it excites the mucous tissues to inordinate action, and produces catarrh and other symptoms of undue oxidation. Diphtheria has been stated to have followed the course of an abnormal development of elemental ozone. On the contrary, if ozone be materially diminished in quantity, or a period of positive antozone occur, the system having lost a natural stimulus, the vitality languishes, contagion spreads, and fevers which have for their vehicle the proto-carburet of hydrogen are widely disseminated. It would hence follow, *à priori*, that the more concentrated the epidemic the lesser quantity of ozone would be in the air, and experiments have to a certain degree substantiated the fact. During the latter portion of the hot and arid summer of 1865, when the fatal pestilence raged almost universally amongst our cattle, the germs of epizootic disease lay for weeks together fretting and sweltering under the aspect of a cloudless sky and the rays of a burning sun, and the plague was wafted far and wide, resistless and uncontrollable by human agency. The generation of ozone was frequently found to be below its natural standard.

It is stated by Schönbein, that when ordinary oxygen, such as exists in the atmosphere, enters into combination with oxidizable matters, organic or inorganic, in the presence of moisture, the molecule of neutral oxygen becomes split up into two oppositely active atoms, and undergoes *chemical polarization*, which accounts for the changes which take place in the tissues of the animal organization. The oxygen we inhale, therefore, when in contact with the circulating fluid, is quickly decomposed into ozone and antozone, and both combine with organic matter, and are subsidiary to the various processes of oxidation which are perpetually going on in the human system.

Thus far Schönbein. If the facts I have briefly laid before you be corroborated by future observers, their importance can scarcely be over-estimated. What a glorious day would dawn on medical science if the pathological analyst were enabled to trace to their primeval source the destructive and fell diseases to which humanity is subject!

I have endeavoured to give, almost chronologically, from my notes, written and published, a condensed epitome of ascertained physical facts relating to this interesting but difficult branch of natural science. It is difficult; for, as we have seen, sciolists still squabble on the very threshold of the inquiry. But it is to be mastered, and the obscurity dispelled. It is also abundantly interesting; and I shall rejoice, when far away, to learn that you—the members of this rising Eastbourne Society—have borne your part in clearing away a portion of the obscurity by which it is surrounded.—*Paper read before the Eastbourne Natural History Society.*

ON STAR-GROUPING, STAR-DRIFT, AND STAR-MIST.

BY RICHARD A. PROCTOR, B.A., F.R.A.S.

IN THREE PARTS.—PART I.

NEARLY a century has passed since the greatest astronomer the world has ever known—the Newton of observational astronomy, as he has justly been called by Arago—conceived the daring thought that he would gauge the celestial depths. And because in his day, as indeed in our own, very little was certainly known respecting the distribution of the stars, he was forced to found his researches upon a guess. He supposed that the stars, not only those visible to the naked eye, but all that are seen in the most powerful telescopes, are suns, distributed with a certain general uniformity throughout space. It is my purpose to attempt to prove that—as Sir Wm. Herschel was himself led to suspect during the progress of his researches—this guess was a mistaken one; that but a small proportion of the stars can be regarded as real suns; and that, in place of the uniformity of distribution conceived by Sir Wm. Herschel, the chief characteristic of the sidereal system is *infinite variety*.

In order that the arguments on which these views are based may be clearly apprehended, it will be necessary to recall the main results of Sir Wm. Herschel's system of star-grouping.

Directing one of his twenty-feet reflectors to different parts of the heavens, he counted the stars seen in the field of view. Assuming that the telescope really reached the limits of the sidereal system, it is clear that the number of stars seen in any direction affords a means of estimating the relative extension of the system in that direction, provided always that the stars are really distributed throughout the system with a certain approach to uniformity. Where many stars are seen, there the system has its greatest extension; where few, there the limits of the system must be nearest to us.

Sir Wm. Herschel was led by this process of star-grouping to the conclusion that the sidereal system has the figure of a cloven disk. The stars visible to the naked eye lie far within the limits of this disk. Stars outside the relatively narrow limits of the sphere including all the visible stars, are separately invisible; but where the system has its greatest extension, these orbs produce collectively the diffused light which forms the Milky Way.

Sir John Herschel, applying a similar series of researches to the southern heavens, was led to a very similar conclusion. His view of the sidereal system differs chiefly in this respect from his father's, that he considered the stars within certain

limits of distance from the sun to be spread less richly through space than those whose united lustre produces the milky light of the galaxy.

Now it is clear that if the supposition on which these views are based is just, the three following results are to be looked for:—

In the first place, the stars visible to the naked eye would be distributed with a certain general uniformity over the celestial sphere; so that if on the contrary we find certain extensive regions over which such stars are strewn much more richly than over the rest of the heavens, we must abandon Sir Wm. Herschel's fundamental hypothesis and all the conclusions which have been based upon it.

In the second place, we ought to find no signs of the aggregation of lucid stars into streams or clustering groups. If we should find such associated groups, we must abandon the hypothesis of uniform distribution and all the conclusions founded on it.

Thirdly, and most obviously of all, the lucid stars ought not to be associated in a marked manner with the figure of the Milky Way. To take an illustrative instance. When we look through a glass window at a distant landscape we do not find that the specks in the substance of the glass seem to follow the outline of valleys, hills, trees, or whatever features the landscape may present. In like manner, regarding the sphere of the lucid stars as in a sense the window through which we view the Milky Way, we ought not to find these stars, which are so near to us, associated with the figure of the Milky Way, whose light comes from distances so enormously exceeding those which separate us from the lucid stars. Here again, then, if there should appear signs of such association, we must abandon the theory that the sidereal system is constituted as Sir Wm. Herschel supposed.

It should further be remarked that the three arguments derived from these relations are independent of each other. They are not as three links of a chain, any one of which being broken the chain is broken. They are as three strands of a triple cord. If one strand holds, the cord holds. It may be shown that all three are to be trusted.

It is not to be expected, however, that the stars as actually seen should exhibit these relations, since far the larger number are but faintly visible; so that the eye would look in vain for the signs of law among them, even though law may be there. What is necessary is, that maps should be constructed on a uniform and intelligible plan, and that in these maps the faint stars should be made bright, and the bright stars brighter.

The maps exhibited during this discourse have been devised for this purpose amongst others. There are twelve of them, but they overlap, so that in effect each covers a tenth part of the heavens. There is first a north-polar map, then five maps symmetrically placed around it; again, there is a south-polar map, and five maps symmetrically placed round that map; and these five so fit in with the first five as to complete the enclosure of the whole sphere. In effect, every map of the twelve has five maps symmetrically placed around it and overlapping it.[1]

Since the whole heavens contain but 5,932 stars visible to the naked eye, each of the maps should contain on the average about 593 stars. But instead of this being the case, some of the maps contain many more than their just proportion of stars, while in others the number as greatly falls short of the average. One recognizes, by combining these indications, the existence of a roughly circular region, rich in stars, in the northern heavens, and of another, larger and richer, in the southern hemisphere.

To show the influence of these rich regions, it is only necessary to exhibit the numerical relations presented by the maps.

The north-polar map, in which the largest part of the northern rich region falls, contains no less than 693 lucid stars, of which upwards of 400 fall within the half corresponding to the rich region. Of the adjacent maps, two contain upwards of 500 stars, while the remaining three contain about 400 each. Passing to the southern hemisphere, we find that the south-polar map, which falls wholly within a rich region, contains no less than 1,132 stars! One of the adjacent maps contains 834 stars, and the four others exhibit numbers ranging from 527 to 595.

It is wholly impossible not to recognize so unequal a distribution, as exhibiting the existence of special laws of stellar aggregation.

It is noteworthy, too, that the greater Magellanic cloud falls in the heart of the southern rich region. Were there not other signs that this wonderful object is really associated with the sidereal system it might be rash to recognise this relation as indicating the existence of a physical connection between the Nubecula Major and the southern region rich in stars. Astronomers have indeed so long regarded the Nubeculæ as belonging neither to the sidereal nor to the nebular systems, that they are not likely to recognise very readily the existence of any such connection. Yet how strangely perverse *is* the reasoning which has lead astronomers so to regard these amazing objects. Presented fairly, that evidence amounts simply to this:—The Magellanic clouds contain stars and they contain nebulæ, therefore they are neither nebular nor stellar. Can perversity of reasoning be pushed farther? Is not the obvious conclusion this, that since nebulæ and stars are *seen* to be intermixed in the Nubeculæ, the nebular and stellar systems form in reality but one complex system.

As to the existence of star-streams and clustering aggregations, we have also evidence of a decisive character.[2] There is a well-marked stream of stars running from near Capella towards Monoceros. Beyond this lies a long dark rift altogether bare of lucid orbs, beyond which again lies an extensive range of stars, covering Gemini, Cancer, and the southern parts of Leo. This vast system of stars resembles a gigantic sidereal billow flowing towards the Milky Way as towards some mighty shore-line. Nor is this description altogether fanciful, since one of the most marked instances of star-drift presently to be adduced refers to this very region. These associated stars *are* urging their way towards the galaxy, and that at a rate which, though seemingly slow when viewed from beyond so enormous a gap as separates us from this system, must in reality be estimated by millions of miles in every year.

Other streams and clustering aggregations there are which need not here be specially described. But it is worth noticing that all the well-marked streams recognised by the ancients seem closely associated with the southern rich region already referred to. This is true of the stars forming the River Eridanus, the serpent Hydra, and the streams from the water-can of Aquarius. It is also noteworthy that in each instance a portion of the stream lies outside the rich region, the rest within it; while all the streams which lie on the same side of the galaxy tend towards the two Magellanic clouds.

Most intimate signs of association between lucid stars and the galaxy can be recognised,—(i.) in the part extending from Cygnus to Aquila; (ii.) in the part from Perseus to Monoceros; (iii.) over the ship Argo; and (iv.) near Crux and the feet of Centaurus.—*Lecture before the Royal Institution.*

Submarine Forest.—In a recent number of *Les Mondes*, Dr. Quenault states that he has discovered, near Hauteville-sur-Mer, close to a rock (in the Atlantic Ocean and near the French shore), known as Le Manlieu, a layer of peaty material, wherein are embedded trunks of trees yet held by their roots. Although at a depth of 12 mètres under water, the oak is in a perfect state of preservation, but all other kinds of wood have become soft and spongy. The author supposes that this forest was submerged in the eighth century.

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[1] It will be understood that the description here, and all which immediately follows, replaces portions of the discourse which would only be intelligible when illustrated by means of the diagrams and illuminated maps actually employed.

[2] Here, again, without the illustrative maps the argument is necessarily rendered imperfect.

ON THE PERIODS OF CERTAIN METEORIC RINGS.

BY PROFESSOR DANIEL KIRKWOOD.

I.—The Meteors of April 20th.

In the *Astronomische Nachrichten*, No. 1632, Dr. Weiss called attention to the fact that the orbit of the first comet of 1861 very nearly intersects that of the earth, in longitude 210°, the point passed by the latter at the epoch of the April meteoric shower. A relation between the meteors and the comet, similar to that recently detected between the November meteors and the comet of 1866, was thus suggested as probable. Is this hypothesis in harmony with facts?—and, if not, are our present data sufficient for determining with any reasonable probability, the true period of the April meteors?

Dates of the April Shower.—Professor Newton selects the following from Quetelet's Catalogue as belonging to this period :—[1]

1.	B.C. 687	4.	A.D. 1093, '4, '5, and '6
2.	,, 15	5.	,, 1122, '3
3.	A.D. 582	6.	,, 1803,

Period of the First Comet of 1861.—The elements of this body were computed by Oppolzer, who assigned it a period of 415·4 years. Now, while it is true that the interval from B.C. 687 to A.D. 1803, is very nearly equal to six periods of 415 years, the slightest examination will show that this period does not harmonize with *any of the intermediate dates*. This fact, then, without further discussion, seems fatal to the hypothesis that the period of the meteors is nearly equal to that of the comet.

What is the probable period of the ring?—The showers of 1093-6 and 1122-3 at once suggest a period of from 26 to 30 years. The nodal passage of the densest portion of the ring at the former epoch may be placed anywhere between 1093 and 1096, and that of the latter, in either 1122 or 1123. The entire interval from B.C. 687 to A.D. 1803 is 2490 years, or 88 periods of 28·295 years each; and the known dates are all satisfied by the following scheme :—

			Years.		Years each.
B.C.	687 to B.C.	15	672·000 = 24	periods of	28·000
,,	15 to A.D.	582	597·000 = 21	,,	28·420
A.D.	582 to ,,	1093·714	511·714 = 18	,,	29·429
,,	1093·714 to ,,	1122·143	28·429 = 1	,,	28·429
,,	1122·143 to ,,	1803	680·857 = 24	,,	28·369

These coincidences indicate a period of about 28⅓[2] years, corresponding to an ellipse whose major axis is 18·59. Hence the distance of the aphelion is very nearly equal to the mean distance of Uranus. It will also be observed that the time of revolution, which seems to have been somewhat lengthened about the Christian era, was previously one-third of the period of Uranus.

II.—The Meteors of December 11th—13th.

In the catalogue of Quetelet we find the four following extraordinary displays which belong undoubtedly to this period. Observations made in England, 1862, indicate also a more than ordinary number of meteors at the December epoch in that year.

1. A.D. 910.—"The whole hemisphere was filled with those meteors called falling stars, the ninth of Dhu'lhajja (288th year of the Hegira) from midnight till morning, to the great surprise of the beholders, in Egypt."—*Modern part of the Universal History*, 8vo. vol. ii., p. 281. Lond. 1870. The date of this phenomenon corresponds to the December epoch, A.D. 901.

2. 930.—"Averse remarquable d'étoiles filantes en Chine."

3. 1571.—"On vit à Zurich 'du feu tomber du ciel.'"

4. 1830, 1833, and 1836.—The maximum seems to have occurred in 1833, when as many as ten meteors were seen simultaneously. "Dans la nuit du 11 au 12 décembre, on vit, à Parme une grande quantité d'étoiles filantes de différentes grandeurs, qui se dirigeaient presque toutes avec une grande vitesse vers le S.S.E. A 10 heures et ¼, entre les seules constellations du Bélier et du Taureau, on en compta environ une dizaine."

5. (Doubtful.) 1861, 1862, and 1863. Maximum probably in 1862. The meteors at this return were far from being comparable in numbers with the ancient displays. The shower, however, was distinctly observed. R. P. Greg, Esq., of Manchester, England, says the period for December 10th—12th was, in 1862, "exceedingly well defined."[3]

These dates indicate a period of about 29¼ years, thus :—

901 to 930	.....	1 period of 29·000 years.
930 to 1571	.....	22 periods of 29·136 years.
1571 to 1833	.....	9 periods of 29·111 years.
1833 to 1862	.....	1 period of 29·000 years.

III.—The Meteors of October 15th—21st.

The showers of the following years (see Quetelet's Catalogue) belong to this epoch :—

1. 288. "Apparition en Chine."

2. 1436 and 1439. In each year a remarkable apparition was observed in China.

3. 1743. (Quoted from Herrick, in *Silliman's Journal* for April, 1841.) "A clear night, great shooting of stars between 9 and 10 o'clock, all shot from S. W. to N. E. [Qy. N. E. to S. W.?]. One like a comet in the meridian very large, and like fire, with a long broad train after it, which lasted several minutes; after that was a train like a row of thick small stars for twenty minutes together, which dipt N."

4. 1798. "Brandès marque, à Goettingue, un grand nombre d'étoiles filantes dans les observations simultanées qu'il fait avec Benzenberg."

These dates indicate a period of about 27½ years :—

288 to 1439	.....	42 periods of	27·405	years each.
1439 to 1743	.....	11 ,,	27·636	,,
1743 to 1798	.....	2 ,,	27·500	,,

If these periods are correct, it is a remarkable coincidence that the aphelion distances of the meteoric rings of April 18th—20th, October 15th—21st, November 14th, and December 11th—13th, as well as those of the comets 1866 I. and 1867 I. are all nearly equal to the mean distance of Uranus.—*Paper read before the American Philosophical Society*, March 4th.

[1] *Silliman's Journal* for July, 1868.

[2] Herrick assigned a value of twenty-seven years. See *Silliman's Journal* for April, 1841, p. 365.

ON IRONCLAD SHIPS.

BY E. J. REED, ESQ., C.B.
Chief Constructor of the Navy.

In Two Parts.—Part II.

The changes in the dispositions of armour on our ironclads are also important. They chiefly consist in the adoption of the "belt-and-battery" system for broadside ships, and of the "breastwork" system for monitors. By means of these improvements the vital parts of ironclads—such as the region of the water-line, the batteries or turrets in which the guns are fought, and the steering apparatus—are well protected; and the horizontal range of the guns carried behind armour is increased so as to give them an "all-round fire" instead of the very limited range possessed by the guns of the *Warrior* and other early ships. These changes have been facilitated by the tendency of late years to reduce the number of the guns carried, and to considerably increase the power of each gun.

Not less important are the changes made in the structure of

[3] *Silliman's Journal* for May, 1863, p. 401.

our recent iron-clads, for by these changes the ships have been made stronger and safer than their predecessors, while they have proportionately lighter hulls. As an example, the cases of the early iron-clad *Defence* and the recent iron-clad *Invincible* may be taken. They are of nearly equal size; but while in the *Defence* the hull weighs 3,500 tons and carries something under 2,500 tons, in the *Invincible*, a hull weighing less than 2,700 tons, carries more than 3,200 tons. What is saved on hull can obviously be put into armour; and had the *Defence* been built on the improved "bracket" system, she would have been able to carry twice as much armour as she actually does. Structural changes of this kind, combined with the changes previously referred to, have given us a fleet of powerful and handy ships, such as could not otherwise have been obtained; and have effected savings in expenditure that may be roundly stated at £100,000 per ship for first-class iron-clads.

The changes recently made have had another important effect, which as yet has not been brought into prominence, although it deserves careful attention—*viz.*, the much smaller straining forces short ships have to resist on account of their shortness and the concentration of their weights. Careful calculations show, for example, that for some positions afloat the *Minotaur* may be strained *three* times as much as the *Bellerophon;* and yet, to say the least, the shorter ship is as strong to resist these strains as the larger one. Taking the greater margin of strength of the short ship into account, and remembering the rapidity and violence of the changes of strain in ships pitching and tossing at sea—which, as it were, send *waves* of strain through the structure—it will be evident that the shorter type is likely to prove more durable than the longer, in addition to being superior in other respects.

A consideration which has justly had much weight in the reconstruction of our Navy, has been the necessity for giving most of our iron-clads sail-power, in addition to steam-power, so that they can keep the sea and cruise for considerable periods. This has also had much to do with the large adoption of the broadside principle in our ships, as it is better adapted to full-rigged ships than the turret principle, on account of the fact that the horizontal range of the guns is not interfered with by the rigging, while the fire of turret guns must be to some extent. In addition, the general requirements of a sea-going ship can be far better met in broadside ships. The turret principle may, of course, be carried out in rigged vessels, and has been applied to the *Captain* and *Monarch* with much success; but it is, in our opinion, much better suited to ships without masts or sails—such as our recent monitors—where the turret-guns have an all-round fire. These monitors are not cruising ships; but they have extremely large coal supplies, and, on an emergency, can proceed to the Mediterranean or cross the Atlantic. Wherever they go, they will be free to fight without the encumbrance of masts or spars, and without the many risks in battle which rigging entails. Proposals to equip monitors of the American pattern—which is entirely different from our breastwork system—as sailing vessels have been made more than once; but they have not been adopted, because sufficient provisions for stores, equipment, accommodation, &c., have not been made, and (which is far more serious) because such vessels would run a great risk of upsetting when under canvas, on account of their deficient stability in inclined positions. Careful calculations have shown this to be the fact.

Iron-clad ships are very generally believed to be heavier rollers than unarmoured ships, because of the loads they carry on their top sides. Facts, however, prove them to be steadier than wood line-of-battle ships, and show that *raising* the weights on board tends to make ships roll less. The iron-clad two-deckers, *Magenta* and *Solferino*, are the steadiest French iron-clads. In designing some recent ships at the Admiralty, special care has actually been taken to raise weights in order to make the vessels steadier; modifications in the form may also be made to conduce to this result.

The burdens of armour carried by our ships are, of course, large; and though our iron-clads are called frigates, they are really heavier and larger than our largest three-deckers were. As experience has been gained and improvements have been made, we have gradually advanced in the proportion borne by the weight of armour to the total weight of the vessel. In the *Warrior* the armour weighs less than one-ninth the total weight; in the *Bellerophon* it slightly exceeds one-seventh; in the *Hercules* it exceeds one-sixth; and in the monitor *Thunderer* it considerably exceeds one-fourth. In fact, the *Warrior*, with a total weight of about 9,100 tons, carries only 975 tons of armour; while the *Thunderer*, on a rather less displacement, carries 2,370 tons of armour on sides, turrets, and decks. The monitor, as was said above, has no masts or sails, and is of only moderate speed as compared with the *Warrior*, both of which causes help to increase the proportionate weight of armour.

The limit of thickness in armour has not yet been reached. Beginning with 4½-in. plates, we have in ten years reached 14-in., and may go on to 20-in., or even 24-in. plates—by means of improved arrangements not yet divulged—*without making* iron-clads of extravagant sizes. In fact the dimensions required for ships to carry the maximum thickness mentioned, need not exceed those of ships we actually possess. At present our strongest ships are impregnable to the heaviest guns; and as we can, when necessary, about double the thickness of their armour, it becomes very doubtful whether guns will soon be produced capable of beating the armour out of the field. It is much more probable that ramming and other modes of attack will take the place of artillery.—*Lecture delivered before the Royal Institution.*

NICOTIANA MACROPHYLLA.

WE would call the attention of those interested in scientific horticulture to the illustration, on page 467, of the above plant. The species is one which, besides being a handsome garden plant, has a certain economic value abroad, being rather extensively used in Germany for the manufacture of a superior variety of tobacco. It grows to the height of four or five feet; and, being crowned with beautiful purple flowers, it is a plant which may with great advantage be grown in beds or in isolated groups. The seed may be obtained from Messrs. Dick Radclyffe & Co., the eminent seedsmen of Holborn, at a sum so small as to be almost nominal.

Scotch Silver Mines.—The *Mining Journal* states that the ancient silver mines on the Bathgate Hills, which are situated about three miles from the town of Bathgate, have been leased by Mr. Henry Aitken, coalmaster, Falkirk, from the Earl of Hopetoun. These mines were worked for many years by King James VI. of Scotland, but owing to a want of proper machinery at that period, the yield did not pay the working. The king, it is stated, brought a great number of skilled workmen from Germany, who explored the hills, wrought the ore, and extracted from it silver and lead, the latter, however, being greatest in quantity. Several small nuggets of gold have also been found on different occasions. Silver pieces, coined from the produce of the mines during the period when Linlithgow was the residence of royalty, are still extant. The place where the metal was formerly smelted is to this day called Silver Mill, and the farm on which the quarries or mines exist is called the Silver Mine. For many years the vein was lost, but about six or seven years ago a number of gentlemen belonging to Bathgate subscribed money and recommenced operations. They found out part of the lost workings, and also came upon a new vein of silver, which runs downwards through limestone rock. The quantity of ore extracted on that occasion was worth about £230; but the whole of it was taken away in the shape of specimens and mantlepiece ornaments by geologists and others. The gentlemen referred to were advised to trace this vein until it went through the limestone rock; but, in consequence of pecuniary difficulties, the workings were abandoned. It is believed, however, that through the energy of Mr. Aitken the subject will now be thoroughly investigated, and the value of the mines properly ascertained.

NICOTIANA MACROPHYLLA, VAR. GIGANTEA. [See p. 466.

REVIEWS OF BOOKS.

Lecture Notes for Chemical Students. By EDWARD FRANKLAND, F.R.S., Professor of Chemistry in the Royal School of Mines. Vol. I., Inorganic Chemistry. 2nd edition. London: Van Voorst. 1870.

WE are glad to see that Dr. Frankland, in bringing out a new edition of his excellent *Notes*, has divided the work into two parts, corresponding to the inorganic and organic divisions of the science. To the great mass of students this arrangement will be a boon. The alterations in the present edition are not numerous, but such as they are we must confess that they appear to us to be in the right direction. Notably would we point to the fact, that Crum Brown's graphic formulæ have been deprived of their circles, for it leads us to a hope that in the third edition they may be improved out of existence. We certainly, contrary to Dr. Frankland and other high authorities, deprecate the employment of the species of diagrammatic guesswork involved in the use of graphic formulæ. We believe that its influence over the student is as irresistible as it is pernicious, and we trust that ere long the development of a more positive school of chemistry may lead to its banishment from our books. Apart, altogether, from the fact that chemical bodies undergo their metamorphoses in a definite relation to certain figures which represent weight, we know nothing of atomic constitution, and such a thing as an atom is just as great an impossibility as the idea of a big wall limiting space and closing in the universe. Indeed, the dogmatism of certain chemists on this question reminds us of the curious archetype plans which some biologists would have us believe a creator set before him, lest he might make a mistake in cutting out the manifold patterns of animal life. Such things result from giving a false realism to mere dreamy and pleasant speculation; but they are out of keeping with true philosophy; and, with the help of a little more positivism, the study of phenomena will soon drive the graphic formulæ into the "curiosity shops" of chemical science.

The Mammalia of Massachusetts. By J. A. ALLEN, Cambridge (U.S.A.) University Press.

THE Museum of Comparative Zoology of the Harvard College has from time to time published in its Bulletins various valuable contributions to zoology, but none, we think, is more creditable to the University than the excellent catalogue of the Massachusetts mammals now before us. It is, we believe, the fact, that the local American naturalists have paid more attention to the birds than to the mammals of the State in question, and though one or two previous local lists have been published, there was still much work to be done towards the formation of a complete fauna, such as that which Mr. Allen has published. Our eulogy of this work may seem overdrawn by those who are familiar with the usual nature of local lists of animals. But we would remark that the present is quite an exceptional volume, for it is in great measure a philosophical essay on some of the causes which influence the distribution of animals; and the author is, above all, a man who abominates the mere new-species-hunting naturalist. We commend the following observations of Mr. Allen's to the notice of some of those who cannot admit varieties:—

"I can hardly avoid a word or two in reference to the spirit which evidently incites many zoologists in their researches. I refer, of course, to that eagerness for describing new species so patent in all their publications—an influence highly derogatory to the advancement of scientific knowledge. It tends to divert attention from such a critical study of those species living in the naturalist's immediate vicinity as will alone acquaint him with the amount of variation a species may be expected to present. . . . . The inquiry with many naturalists respecting doubtful specimens seems rarely to be whether they may not be referred to some already known species, and the points of resemblance to their nearest known ally accordingly carefully weighed against the differences, but *rather are not they sufficiently different to warrant a description of them as new species?*"

These remarks are a sort of indication of the sterling qualities of this fauna-work. All through the book the same high philosophic tone exists; each specific name being the heading of a little chapter on the peculiar variation of the species described. Under the Section *Mustelidæ* we find some very valuable collected information, anent the singular metamorphosis of colour seen in the case of certain fur-bearing mammals. Altogether, this list is a very model for future zoologists.

Irregularities and Diseases of the Teeth. By HENRY SEWILL, M.R.C.S., L.D.S. London: Churchill. 1870.

MR. SEWILL is probably a very intelligent and skilful practical dentist, but he is a very poor logician, and he seems to be devoid of that power of associating together a large number of facts, which is so essential to the forming of just and unimpeachable conclusions. In this little *brochure* of his, he gives us some admirable illustrations of the *deformities* arising (*a*) from embryonic abnormalities of the maxilla and pre-maxilla, (*b*) from certain abnormal growths of the permanent teeth, and (*c*) from injury, such as burns of the neck, which draw the inferior maxilla downwards and forwards. He further explains very clearly some of his own ingenious methods (methods, too, which have been successful) for preventing the second class of deformity. In all that he says on these points we give him every praise. But when he attempts to philosophize on the causation of facial neuralgia, he falls into a vulgarity characteristic of an inferior order of dental surgeons, and tries to assert—for his arguments are beneath serious criticism—that facial neuralgia is almost invariably the result of decayed teeth. We could have wished that Mr. Sewill, for his own sake, had avoided a problem the most difficult of solution in the whole range of ætiology, and we cannot but say that his reasonings on the question are amusingly suggestive of the *Medicin malgre lui*. For all that we have said, however, Mr. Sewill's little book will be found a useful addition to the literature of its subject.

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Notes de Cosmographie rédigées conformément au Programme officiel. Par J. Dufailly, Professeur au Collége Stanislas. Paris. Delagrave et Cie.

Rapport sur l'Acclimatisation du Saumon en Tasmanie. Par le Docteur J. Léon Soubeiran. Paris. Martinet.

Recherches sur le Système latéral du Nerf pneumogastrique des Poissons. Résumé d'Anatomie. Par le Docteur J. S. Fort, Professeur libre d'Anatomie. Avec 73 figures dans le texte. Paris. Delahaye.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

NEW LIVING CORALS.—*From* WM. S. KENT, F.L.S., F.R.M.S.[1]

SIR,—In the last week's number of your journal, and under the above heading, a species of Madrepore is described by Mr. P. H. Gosse, F.R.S., as new to science, under the name of *Paracyathus nobilis*. A fine series of living specimens of this coral were exhibited by Mr. King at the meeting of the Zoological Society, held on the 26th of April last, and on which occasion, my opinion being asked concerning them, I expressed my belief that the species was the *Balanophyllia verrucaria* of Milne Edwards and Haime, a form of frequent occurrence in the Mediterranean.

To precisely define a species of coral, it is necessary, however, to divest it of all the adherent organic matter, when the characters of the true skeleton, or corallum become clearly apparent. A specimen having been placed at my disposal, I submitted it to the necessary treatment, and it was then clearly shown that my first surmises were not without foundation.

With all deference to Mr. Gosse's extensive knowledge of our British non-coral forming Zoantharia or Actinidæ, he has evidently fallen into error regarding the structure and affinities of the species he has just called attention to. In the first place, by referring it to the genus *Paracyathus*, he places it in the family Turbinolidæ, of the section *Madreporaria aporosa*, whose representatives are characterised by the dense and non-porous structure of their corallum; while this species, as is apparent on the most superficial examination, belongs to that group known as the *Madreporaria perforata*, or corals which are almost entirely composed of a porous or reticulate general tissue or "sclerenchyma;" and even if the species did belong to the first-mentioned group, the characters of the columella and so-called pallules of Mr. Gosse would entirely forbid its being referred to the genus *Paracyathus*.

Having had the privilege of studying Milne Edwards's type specimens of *Balanophyllia verrucaria* in the Paris Museum, and having also identified specimens preserved in the British Museum as belonging to the same species, the great similarity existing between them and the form recently collected and brought to England alive, I believe, for the first time, by Mr. King, struck me most forcibly, and my attention having been directed to Mr. Gosse's article in your last week's number, I hasten to secure more specimens for comparison, and have hence now before me a series of some fifty or sixty individuals, a quantity which, although not absolutely indispensable, greatly facilitates one in forming a correct appreciation of the affinities and degree of variation of a species.

Balanophyllia verrucaria, in accordance with Milne Edwards, may be described as follows:—

Corallum short, straight, compressed superiorly; attached by a base equalling at least the size of the calyx. Epitheca extending only half way up its height. Costæ moderately fine, crowded, subvermicellate. Calyx usually oval, and having the form of a figure of 8, in consequence of the pressing in of the shorter axis. Calicular fossæ large and deep. Columella well developed, the surface plane, finely spongious, formed of slender trabicular lamellæ. Septa not exsert, forming five cycles; the divergence of the last cycle not very conspicuous, slightly crowded, slender, inclining to coalesce exteriorly, those of the first orders having their edges sub-entire or very finely denticulate; the remaining ones perforate and having their edges irregularly crenate. Height, 15 millimètres; long axis of the calyx, 15; shorter axis, 7; depth of calicular fossa, 6. Habitat, Corsica.

There is not a single character in the above-description that precludes Mr. Gosse's form from being associated with it. The species is extremely liable to variation, as is instanced in the number of specimens now before me; some having their calices elliptical, and being of uniform size from the summit to the base, and others being circular and tapering rapidly towards their point of attachment. In the development of the columella the individuals also vary immensely, in some specimens this region occupying more than one half of the area of the calicular fossa, and in others being restricted to simply a small fascicle of trabicular lamellæ. The depth of the calicular fossa is also liable to variation, in many instances being shallow, and in others of considerable depth. The development of the epitheca, again, cannot be made use of as a diagnostic specific character; for, although present in the majority of instances, it frequently happens that it is altogether rudimentary or absent.

One of the most striking points in this supposed new species of coral is Mr. Gosse's description of the "Palules," or, I presume, the pali. He describes these as springing from the columella, joining the "plates" septa of the third cycle, and then sending out lateral branches, which join those of the fourth cycle. He has evidently here entirely misunderstood the significance of the phenomenon he describes; these pali are almost entirely unknown in the *Madreporaria perforata*, and when they do occur in any group of corals whatever, they are structures altogether independent of both the columella and septa. What Mr. Gosse has observed is a character which isolates the Eupsammineæ (with the genus Balanophyllia included) almost entirely from all the other corals; this is, the tendency of the later developed septal cycles to assume a divergent and arcuate form, which brings them in contact with septa of preceding cycles, with which they coalesce, and then proceed with an uninterrupted course to form a junction with the columella. A figure of this species, *B. verrucaria*, here under discussion, is given by Milne Edwards in his "Monograph des Eupsammides" (*Ann. des Sc. Nat.*, t. x., pl. 1, fig. 6, 6 a, 1848); and though the septa are more slender in the specimens from the French coast than in the Corsican one he figures, it is evident that they are mere local varieties of the same form, modified by certain external conditions, and by comparing a large series it is easy to reduce all to the same type; but even in this respect the amount of variation is far less considerable than what obtains in *Caryophyllia cyathus* of the same seas, and with which the *Caryophyllia Smithii* of our own coasts, and also *C. borealis* of the Shetland seas, has been ably shown by Dr. Duncan to be absolutely identical. Apologising for this intrusion on your valuable space, I remain, Sir, yours very truly,

British Museum, May 14. WM. S. KENT.

P.S. I may add, that a fine series of this handsome species of Balanophyllia is now exhibited in a living condition in the aquaria of the Zoological Gardens.

[1] By a postal accident this letter was received too late for insertion in our last.—[ED. *S. O.*]

FLIGHT.—FIGURE OF 8 WAVE THEORY OF WING MOVEMENTS.

SIR,—In the *Proceedings of the Royal Institution of Great Britain* for March, 1867, Dr. J. Bell Pettigrew, F.R.S., the distinguished curator of the Museum of the College of Surgeons of Edinburgh, announced the startling discovery that all wings, whether those of the insect, bat, or bird, were twisted upon themselves structurally, and that they twisted and untwisted during their action—that, in short, they formed *mobile helices or screws*. In June of the same year (1867) Dr. Pettigrew, following up his admirable researches, read an elaborate memoir, "On the Mechanism of Flight,"[1] before the Linnean Society of London, in which he conclusively proves, by a large number of dissections and experiments, in which he greatly excels, that not only is the wing a screw structurally and physiologically, but, further, that it is a reciprocating screw. He shows, in fact, that the wing, during its oscillations, describes a figure of 8 track, similar in some respects to that described by an oar in sculling. This holds true of the vibrating wing of the insect, bat, or bird, when the bodies of these animals are artificially fixed. When, however, the creatures are liberated, and flying at a high horizontal speed, the figure of 8, as he points out, is, curiously enough, converted into a *wave track*, from the wings being carried forward by the body, and from its consequently never being permitted to complete more than a single curve of the 8. This is an entirely new view of the structure and functions of the wing, and one fraught with the deepest possible interest to the aëronautical world. It promises to solve everything. Dr. Pettigrew's remarkable discovery has received an unlooked-for confirmation within the last few months at the hands of Professor Marey, of the College of France, Paris. This gentleman, who has acquired great celebrity for his improvements and dexterity in the use of the Sphygmograph, has succeeded in causing the wing of the insect and bird to register their own movements, and has established, by an actual *experimentum crucis*, the absolute correctness of Dr. Pettigrew's views. Professor Marey's mode of registering displays much ingenuity, and is briefly as follows. A cylinder revolving at a given speed is enveloped by a sheet of thin paper smeared with lampblack, and to this the tip of the rapidly-vibrating wing of the insect is applied in such a manner as to cause it to brush out its track on the blackened paper, which it readily does. A similar result is obtained in the bird by fixing a registering apparatus to the wing and causing the bird to fly in a chamber. In this case the registering apparatus is connected with the cylinder by

[1] This memoir, which is illustrated by nearly 100 original figures, is published in vol. xxvi. of the *Transactions* of the Society.

means of delicate wires, and the registering is effected by means of electricity. In both cases the *figure of 8 and wave movement*, originally described by Dr. Pettigrew, are faithfully reproduced. It is difficult to foresee what next. The way of a wing in the air has hitherto been regarded as a physiological puzzle of great magnitude; and well it might be, since some insects (the common fly, for example) vibrate their wings at the almost inconceivable speed of 300 strokes per second—that is, 18,000 times in a minute!

I am, Sir, yours, &c., JUSTITIA.

Sunday Lecture Society.

SIR,—As the hon. treasurer, and one of the earliest promoters of this society, I trust you will allow me to say a few words to prevent misconception, which the article on our society in this week's number will be apt to create with many of your readers who may not be acquainted with our origin. I think you must have been led to confuse us with another and perfectly distinct body called the "Church of Progress," whose motives, however, as little deserve to be impugned as those of the founders of our society. So far from having ever contemplated "giving some sort of pseudo-religious character" to our meetings "by opening them with a prayer, or a hymn, or something of that kind," the very idea of our society arose from the objection of several gentlemen, well known and of high repute in the scientific world, to anything like such a pretence as cloaking lectures on science or knowledge under the name of a religious service, or to register themselves as an association for religious "worship," to escape pains and penalties, which many erroneously supposed such a society as ours might be subjected to unless so registered. Our preliminary prospectus, of which I enclose a copy, dated so far back as February, 1869, expressly stated that the delivery of lectures on "science—physical, intellectual, and moral—history, and literature," was the purpose of the society; that it would be "the desire of the society to make the lectures thoroughly interesting, *with the view of attracting even those of the community who would otherwise pass the whole or the greater portion of the day in idleness, or in frivolous and unprofitable pursuits;*" while we added, "No infringement of the Act of Parliament for preventing abuses on Sundays is contemplated—earnest instruction, and not 'entertainment' or 'amusement,' being the main object which the society will have in view." You have kindly, but most justly, testified to our having kept to what was but the original intention; and I trust this letter will satisfy your readers who are not already members of our society, but whom we shall cordially welcome if they join us, that our "motives will bear inquiry into," and that our "achievement," whatever its present worth may be, is not due to any "unworthy influences." Our great object has been, while protesting against bitter and irrational Sabbatarianism, to steer clear of theological disputes and wrangles; to be able honestly to say, "whatever your *creed* may be, come to our lectures; we lecture on subjects which are of interest and of use to the whole world; and, as far as possible, we avoid touching upon those questions which are beyond man's power to grasp, and which for hundreds of years have only developed intense feud and bitterness, well known under the name of "odium theologicum." I am, Sir, yours faithfully,

May 21st, 1870. WM. HENRY DOMVILLE.

Permit me to add, Professor Blackie did not require the aid of a glass of beer, as you seem to intimate. Our society's hospitality was restricted to a glass of—I venture to hope, pure and wholesome—water.

Opium in Manila Cigars.

SIR,—Errors, however trifling, are always worth correcting. In your "Answers to Correspondents" of 26th January, Vol. iii., No. 65, you state that opium "is said to be in Manillas" (cigars). Those who entertain this absurd opinion can have but little idea of the cheapness of tobacco here and the high value of opium. It would never pay to mix this drug, even in small quantities, with our excellent tobacco, which certainly needs no such addition.

You may confidently state that *nothing* is used to heighten either the strength or flavour of the "weed" here.

Your obedient servant,

A RESIDENT IN MANILA (not *Manilla*) FOR NEARLY 40 YEARS.

Manila, 17th March, 1870.

On Bicyclism.

SIR,—The question which I proposed and Mr. Barkas endeavours to elude, is medical advice *versus* toleration. I advocated the latter, and it is a pity that athletes do not more often practise it. Not for a moment would I wish to assert that toleration is a perfect substitute for sound medical advice; but it is in many cases far more easily attainable (instance the case of smoking, a point on which numerous physicians are ignorantly dogmatic), and, moreover, in ninety-nine cases out of a hundred, it is the very thing that would be recommended by a medical man.

I am still at a loss to understand what Mr. Barkas means by "*long journeys*." It would seem that he calls a journey long when, at the end of it, your temperature is somewhat raised, your faculties dim, and your hand unsteady; or, as valuable substitutes for such tests, various delightful functions of a medical man, *e. g.*, bowing politely to your patients, or taking out their eyes. Mr. Barkas might as well be writing against horse-riding. He appears to think that no vehicle is or can be useful in the way of pleasure, quite apart from business; and that, though you may be able to go two hundred miles in four days on the bicycle, yet the instrument is of no use for long journeys, unless, at the end of it, your temperature and faculties generally (including, I presume, your capability of bowing blandly and taking out eyes) are the same as if you had been reclining elegantly in a capacious chariot. Everything to its proper use. Bicycles were made for pleasure trips, not for a physician's professional visits; and if they have no right to parade a double qualification, they are not the less sterling on that account. I am, &c.,

May 23. BICYCLIST.

Additional Discoveries in Coal Shales.—From T. P. Barkas, F.G.S.

SIR,—I have received from Messrs. Taylor and Campbell, who are working miners in West Cramlington Colliery, Northumberland, two consignments of fossils found by them in the coal shale of Cramlington and Newsham collieries. Messrs. Taylor and Campbell, both of whom take a deep and intelligent interest in the study of Carboniferous palæontology, belong to that comparatively limited number of working men who are a credit to their order; and who, notwithstanding the laboriousness of their daily work, find time to discover and study the wonderful treasures that lie buried in the crust of the earth, and that are entirely neglected by the great majority, not only of their fellow-workmen, but of the reputedly educated of the human race.

Mr. Taylor has been kind enough to forward me for examination a very beautiful specimen of Acrolepis, found by him in the coal shale of the colliery in which he works. The specimen, although not complete, is tolerably perfect; the length is 8 in. and its extreme width is 3¼ in. The head-bones and jaws are well exposed, and the opercular plates, mandibles, and maxillary bones bear the tubercular markings that are so characteristic of Acrolepis. The scales, which are scattered about, are very numerous, and have the well-defined peculiarities of the scales of Acrolepis, although the ridges and grooves on the scales are somewhat finer than are those of ordinary specimens of fishes of that genus. In point of fineness the markings are not unlike those of Pygopterus and Gyrolepis, but the directions of the striations do not correspond with those of the two genera named, and do exactly correspond with those of the genus to which I have referred them. This, I believe, is the first tolerably complete specimen of Acrolepis that has been discovered in Cramlington Colliery, and to Mr. Taylor belongs the honour of the discovery.

The contribution from Mr. Campbell is more various and more original. Among the specimens sent are well-exposed ribs of Ctenodus, associated with what appears to be a sphenoid bone, probably of the same genus. A portion of a rib, 4½ in. long, flattened in a manner resembling the ribs of Anthracosaurus. The proximal extremity of a large rib, very closely resembling those said to belong to Anthracosaurus, with deep lateral groove, but differing from other ribs in my possession of that coal-measure reptile, in having a large expansion of bone on the convex side of the rib, close to the articular extremity. Two mandibles of what appears to me to be a new species of Megalechthys, more closely resembling in surface markings *M. coccolepis* than any other species of that genus; but so markedly different from *M. coccolepis* as to justify the formation of a species entirely new, and not a mere variety of Coccolepis, as the tubercles on their surfaces are irregularly scattered, and stand up in the form of distinct papillæ. I, therefore, propose for it the name of *Megalechthys tuberculatus*. Another large mandible of Megalechthys, with much-curved, large, laniary teeth, and well-exposed villiform teeth; a large premaxilla of Phenodopsis; a large semi-cartilaginous bone resembling a sphenoid; and associated with it, and even impressed upon it, some large teeth of *Diplodus gibbosus*. The large bone is probably a sphenoid of Diplodus. Lastly, a slab of shale, 11 in. long and 7 in. broad, on which rests a strong, irregular, undulating jaw, 5 in. long, containing 11 broken teeth, and unlike any jaw I have previously examined. Near the jaw there is lying a large bone, deeply marked with replete reticulations, and very closely resembling in form the scapula and coracoid of a bird anchylosed together. The length of what appears to be the scapular part, including the base of attachment for supposed scapula and coracoid, is 5 in. long; the length of the supposed coracoid, measured in

the same manner, is 3 in., and the width of each is about ¾ in.; they are in the form of a V, with the limbs of the V of unequal length. If this be, what hypothetically I suggest it is, then we have flying reptiles carried back from the Liassic to the Carboniferous era.

Another, and not improbable hypothesis, is that the bones in question are the ischium and pubis of one of the ornithosauria of the coal period, and that its solid part, to which they are attached, is the ilium.

I have no desire to speak dogmatically in reference to this unique bone. The knowledge of the comparative anatomy of palæozoic reptiles is as yet so immature and circumscribed, that dogmatism is unbecomingly absurd; and I, therefore, merely indicate two theories, one of which may eventually be proved correct.

I am, yours obediently, T. P. Barkas, F.G.S.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

May 5th.—The Bakerian lecture was delivered by John W. Dawson, LL.D., F.R.S., &c., Principal and Vice-Chancellor of M'Gill College, Montreal, "On the Pre-Carboniferous Floras of North-eastern America, with especial Reference to that of the Erian (Devonian) Period." The following is an abstract:—The attention of the author was first directed to the Devonian, as distinguished from the Carboniferous flora, by the discovery, on the part of Sir W. E. Logan, in 1843, of some remarkable remains of plants in the sandstones of Gaspé, Canada. In 1859, after visiting Gaspé to study these plants *in situ*, descriptions of them, and more particularly of the two characteristic Lower-Devonian genera Prototaxites and Psilophyton, were published in the *Journal of the Geological Society*.

Subsequently additional material was obtained by personal investigation of the Devonian of Maine and New Brunswick, and, through the kindness of Professor James Hall, from that of New York. These additional plants were also published in the *Journal of the Geological Society*.

Still more recently, a thorough re-examination of the Gaspé beds, the systematic exploration of the plant-bearing beds near St. John by Professor Hartt, and fresh collections made by Professor Hall, have enabled the author to prepare a catalogue of 121 species, and to attempt a thorough revision of the Erian flora, and an investigation of its conditions of growth and relations to the Carboniferous flora.

The term "Erian" is applied to the formations included between the top of the Upper Silurian and the base of the Carboniferous, on account of the uncertainties which have attended the subdivision and limitation of the Devonian of Europe, and also on account of the immense area occupied by these beds on the south and west of Lake Erie, and their admirable development with regard to subdivisions and fossils. The name, "Erie Division," was also that originally applied to this typical series by the geologists of the survey of New York.

A large part of the paper was occupied with the revision of the Erian flora, including the description of twenty-three new species, and more ample descriptions of others previously known only in fragments. Large trunks of Prototaxites, from the base of the Lower Devonian, were described, and full details given of the form, structures, and fructification of two species of Psilophyton. The new genus Ormoxylon was described. The genus Cyclostigma was noticed, as represented by two species in America, and its foliage and fruit described for the first time. The genera of the Erian ferns were examined and corrected, and several interesting trunks and stripes belonging to tree-ferns were described. The fruits of the genus Cardiocarpum were illustrated with reference to their structure. The occurrence of Lepidophloios, Calamodendron, and other forms in the Middle Devonian was noticed for the first time.

The third part of the memoir was occupied with comparisons and general conclusions. At the close of the Upper Silurian period there was a great subsidence of the land in Eastern America, proved by the wide extent of the marine beds of the Lower Helderberg (Ludlow) group. It was on the small areas of Lower Silurian and Laurentian land remaining after this subsidence that the oldest land plants known in the region flourished. Re-elevation occurred early in the Devonian period, and the known flora receives considerable extension in the shallow water beds of the Lower Erian. The subsidence indicated by the great Corniferous limestone interrupted these conditions on the west side of the Appalachians, but not on their eastern side. At the close of this we find the rich Middle Devonian flora, which diminishes toward the close of the period; and, after the physical disturbances which on the east side of the Appalachians terminated the Erian age, it is followed by the meagre and quite dissimilar flora of the Lower Carboniferous; and this, after the subsidence indicated by the Carboniferous limestone, is followed by the Coal-formation flora.

If we compare the Erian and Carboniferous floras, we find that the leading genera of the latter are represented in the former, but, for the most part, under distinct specific forms; that the Erian possesses some genera of its own, and that many Carboniferous genera have not yet been recognized in the Erian. There is also great local diversity in the Erian flora, conveying the impression that the conditions affecting the growth of plants were more varied, and the facilities for migration of species less extensive than in the Carboniferous.

In comparing the Erian flora of America with the Devonian of Europe, we meet with the difficulty that little is known of the plants of the Lower and Middle Devonian in Europe. There are, however, specimens in the Museum of the Geological Survey which show, in connection with facts which can be gleaned from the works of continental writers, that *Psilophyton* occupied the same important place in Europe which it did in America; and in the Upper Devonian the generic forms are very similar, though the species are, for the most part, different.

In Eastern America no land flora is known below the Upper Silurian; and even in that series the plants found are confined to the genus *Psilophyton*. Independently, however, of the somewhat doubtful Lower-Silurian plants stated to have been found in Europe, there are indications, in the Lower-Erian flora, that it must have been the successor of a Silurian flora as yet almost unknown to us; and the line of separation between this old flora and that of the Devonian proper seems to be at the base of the Middle Devonian.

In applying these facts and considerations to the questions relating to the introduction and extinction of species, and the actual relations of successive floras, it was proposed to compare what might be called specific types,—that is, forms which in any given period could not be rationally supposed to be genetically related. Of such specific types, at least fifty may be reckoned in the Erian flora; of these, only three or four are represented in the Carboniferous by identical species, while about one half are represented by allied species. The remainder have no representatives.

A table of specific types of the Erian was given, and its bearing shown on the questions above referred to; and the hope was expressed that by separating such types from doubtful species and varietal forms, some progress might be made towards understanding, at least, the times and conditions in which specific types were introduced and perished, and the range of varietal forms through which they passed.

GEOLOGICAL SOCIETY.

May 11th.—Joseph Prestwich, Esq., F.R.S., president, in the chair. Sir William Bagge, Bart., M.P., of Stradsett Hall, Market Downham, Norfolk; Colonel James Leslie Tait, of Montgomery, Alabama, U.S., and Dr. C. C. Carwana, of the Malta University, were elected Fellows of the Society.

The following communications were read:—

1. "Notes on some specimens of Lower-Silurian Trilobites." By E. Billings, Esq., F.G.S., Palæontologist of the Geological Survey of Canada.

(1) The author first described a specimen of *Asaphus platycephalus*, in which the hypostome was not only preserved *in situ*, but also the remains (more or less well preserved) of eight pairs of legs, corresponding with the eight segments of the thorax, to the under side of which they had been attached. The appendages take their rise close to the central axis of each segment, and all curve forwards, and are thus most probably ambulatory rather than natatory feet. They appear to have had four or five articulations in each leg.

Three small ovate tubercles on the pygidium may perhaps indicate the processes by which the respiratory feet were attached.

Mr. Billings referred to the large number of Trilobites which have been examined, and expressed his belief that only the most perfectly preserved specimens are likely to have the organs on the underside preserved.

(2) Mr. Billings next described the doublure or pleura in the Trilobites, comparing it to that of Limulus. He then proceeded to describe a row of small scars and tubercles on the underside of the pleuræ, to which both Dr. Volborth and Dr. Eichwald believed soft swimming feet or hard horny legs had been attached. As these were first seen by Dr. Pander in a Russian Trilobite, Mr. Billings has called them "Panderian organs." He thinks soft natatory appendages may have been attached to these scars.

(3) Mr. Billings directed attention to the Protichnites and Climactichnites, which he thinks may now be referred to Crustacea, belonging to the division Trilobita.

(4) Finally, Mr. Billings described a section of a rolled-up *Calymene senaria*, the interior cavity of which appears to be full of minute ovate bodies, from 1-80th to 1-100th of an inch in diameter. These small ovate bodies the author believes to be eggs.

2. "Note on the Palpus and other Appendages of Asaphus, from the Trenton Limestone, in the British Museum." By Henry Woodward, Esq. F.G.S. F.Z.S.

Mr. Woodward, when comparing the Trilobite sent over by Mr. Billings, with specimens in the British Museum presented by Dr. J. J. Bigsby, F.R.S., discovered upon the eroded upper surface of one of these, not only the hypostome exposed to view, but also three pairs of appendages, and what he believes to be the palpus of one of the maxillæ. This furnishes an additional fact to Mr. Billings's most interesting discovery, besides confirming its correctness.

Mr. Woodward considers the so-called "Panderian organs" to be only the fulcral points upon which the pleuræ move, and showed that such structures exist in most recent Crustacea.

He considered that the evidence tended to place the Trilobita near to, if not in, the *Isopoda Normalia*.

He remarked that the prominence of the hypostome reminded one strongly of that organ in Apus, and suggested that we might fairly expect to find that the Trilobita represented a more generalized type of structure than their representatives at the present day, the modern Isopoda.

Discussion.—Mr. Woodward had carefully examined Mr. Billings's specimen, and agreed with him in considering that there was undoubted evidence of the presence of walking appendages under the thorax. The presence of such limbs might *à priori* have been expected; and the nature of the test suggested that the Trilobites were walking rather than swimming forms of Isopods. The branchiæ had probably been under the telson, and this would account for its large development. It was not more surprising to find highly-organized Trilobites than it was to find such highly-organized crustaceans as Pterygotus, Eurypterus, and Slimonia in the same beds.

Professor Rupert Jones, Principal Dawson, and Sir Wm. Logan made some remarks, more especially on Protichnites and Climactichnites, the latter having been explained as galleries of Crustacea by Professor Jones, when first exhibited in England.

3. "On the Structure and Affinities of Sigillaria, Calamites, and Calamodendron." By J. W. Dawson, LL.D., F.R.S., F.G.S., Principal and Vice-Chancellor of M'Gill University, Montreal.

The object of this paper was to illustrate the structure and affinities of the genera above named, more especially with reference to the author's previous papers on the "Structures in Coal" and the "Conditions of Accumulation of Coal," and to furnish new facts and conclusions as to the affinities of these plants.

With reference to Sigillaria, a remarkably perfect specimen of the axis of a plant of this genus, from the coal-field of Nova Scotia, was described as having a transversely laminated pith of the Sternbergia type, a cylinder of woody tissue, scalariform internally, and reticulated or discigerous externally, the tissues much resembling those of Cycads. Medullary rays were apparent in this cylinder; and it was traversed by obliquely radiating bundles of scalariform vessels or fibres proceeding to the leaves. Other specimens were adduced to show that the species having this kind of axis had a thick outer bark of elongated or prosenchymatous cells. The author stated that Professor Williamson had enabled him to examine stems found in the Lancashire coal-field, of the type of Binney's *Sigillaria vascularis*, which differed in some important points of structure from his specimens; and that another specimen, externally marked like Sigillaria, had been shown by Mr. Carruthers to be more akin to Lepidodendron in structure. These specimens, as well as the *Sigillaria elegans* illustrated by Brongniart, probably represented other types of Sigillarioid trees, and it is not improbable that the genus Sigillaria, as usually understood, really includes several distinct generic forms. The author had recognised six generic forms in a previous paper, and in his *Acadian Geology*; but the type described in the present paper was that which appeared to predominate in the fossil Sigillarian forests of Nova Scotia, and also in the mineral charcoal of the coal-beds. This was illustrated by descriptions of structures occurring in erect and prostrate Sigillariæ, on the surface of Sternbergia casts, and in the coal itself.

The erect Calamites of the coal formation of Nova Scotia illustrate in a remarkable manner the exterior surface of the stems of these plants, their foliage, their rhizomata, their roots, and their habit of growth. Their affinities were evidently with Equisetaceæ, as Brongniart and others had maintained, and as Carruthers and Schimper had recently illustrated. The internal structure of these plants, as shown by some specimens collected by Mr. Butterworth, of Manchester, and soon to be published by Professor Williamson, showed that the stems were more advanced in structure than those of modern Equiseta, and enabled the author to explain the various appearances presented by these plants when the external surface is preserved, wholly or in part, and when a cast of the internal cavity alone remains. It was further shown that the leaves of the ordinary Calamites are linear, angular, and transversely wrinkled, and different from those of the Asterophyllites properly so called, though some species, as *A. comosus*, Lindley, are leaves of Calamites.

The Calamodendra, as described by Cotta, Binney, and others, and further illustrated by specimens from Nova Scotia, and by several interesting and undescribed forms in the collection of Professor Williamson, are similar in general plan of structure to the Calamites, but much more woody plants: and, if allied to Equisetaceæ, are greatly more advanced in the structure of the stem than the modern representatives of that order. Specimens in the collection of Professor Williamson show forms intermediate between Calamites and Calamodendron, so that possibly both may be included in one family; but much further information on this subject is required. The tissues of the higher Calamodendra are similar to those of Gymnospermous plants. The wood or vascular matter of the thin-walled Calamites consists of multiporous cells or vessels, in such species as have been examined.

In conclusion, a table was exhibited showing the affinities of Sigillariæ on the one hand, through Clathraria and Syringodendron with Lycopodiaceæ; and on the other hand, through Calamodendron with Equisetaceæ; while in the other direction they presented links of connection with Cycads and Conifers.

Discussion.—Mr. Carruthers expressed his thanks for the amount of information given by Mr. Dawson, but was inclined to take a somewhat different view on some of the points mentioned. Some time ago he had, in a paper read to the Society, deduced from the internal structure of Stigmaria, the root of Sigillaria, that the latter was a true cryptogamous plant. He had since met with confirmatory evidence in a specimen of a fluted and ribbed Sigillaria, showing the internal structure of Stigmaria. Mr. Baily, in Devonian strata in Ireland, had found the root, stem, branches, leaves, and fruit of a plant which could, with certainty, be correlated. The root was a Stigmaria, the stem a fluted Sigillaria, the branches and leaves like those of Lepidodendron, and the fruit that of a cryptogram, allied to Lepidodendron. With regard to the American specimens cited by the author, he would not speak with certainty; but he might suggest a different interpretation. The axis was probably foreign to the Sigillaria in which it was found, and was a true coniferous stem composed of pith, medullary sheath, and wood with medullary rays, and vascular bundles passing to the leaves. Plants growing in the interior of decayed Sigillarian stems had been mistaken for organic pith, though they belonged to two or three genera. Dr. Dawson's estimate of Calamites and allied genera essentially agreed with those which he held.

Dr. Dawson thought that the views of Mr. Carruthers and his own might possibly be reconciled, and was not prepared to admit that the plant discovered by Mr. Baily was a true Sigillaria. It belonged, moreover, to the Devonian period, and not to the Carboniferous. He quite agreed with Mr. Carruthers in regarding the stems as closely allied with gymnosperms. He insisted on the layer at the base of the interior of the trunks of the erect Sigillariæ affording evidence of the interior structure of the plant, inasmuch as it consisted of the compressed and decayed inner tissues of the tree. It was curious that similar specimens had not been found in England; but the structures of these plants certainly occur in the English coal, which, like that of Nova Scotia, rests on Stigmaria underclays; and there were other instances of trees being common in the coal-measures of Nova Scotia which were extremely rare in England; and the same discrepancies were found between different American coal-fields.

4. "Notes on the Geology of Arisaig, Nova Scotia," by the Rev. D. Honeyman, D.C.L., F.G.S.—The author referred to a previous paper on the Upper Silurian Rocks of Nova Scotia, which he stated appeared to him now to be generally repetitions of his Arisaig series. He noticed the occurrence of fossils in one of the beds previously supposed to be almost destitute of organic remains, and described the occurrence in Arisaig township of a band of crystalline rocks which appeared to contain Eozoon, and were probably of Laurentian age. A note from Professor Rupert Jones, giving an account of the fossils referred to by Dr. Honeyman, was also read.

Discussion.—Sir W. Logan said that Dr. Hunt had seen the specimens of serpentinous limestone, and considered that they might be Laurentian. Sections of them appeared to Dr. Dawson to show tubulation rather different from that found in Laurentian Eozoon. They might, therefore, belong to a different age.

The following specimens were exhibited to the meeting:—

Specimens of Sigillariæ, Calamites, &c.; exhibited by Principal Dawson and W. Carruthers, Esq.

Specimens of Apiocrinus from the Bradford Clay; exhibited by Mr. Joseph Wood.

Specimens of Trilobites; exhibited by E. Billings, Esq.

ZOOLOGICAL SOCIETY.

May 12th.—Professor Newton, V.P., in the chair. The Secretary read some notes on the principal additions to the society's menagerie during the month of April, and called particular attention to a Vulturine Guinea-fowl (*Numida vulturina*), presented by Dr. John Kirk, C.M.Z.S., being the first living specimen of this rare species received in England.

A communication was read from Dr. R. O. Cunningham, C.M.Z.S.,

on some peculiarities in the anatomy of three King-fishers, *Ceryle stellata*, *Dacelo gigas*, and *Alcedo iepida*.

A communication was read from Mr. George Gulliver, F.Z.S., on the taxonomic characters afforded by the muscular sheath of the œsophagus in Sauropsida and other Vertebrates.

Mr. R. B. Sharpe read a paper containing a full account of the swallows (*Hirundinidæ*) of Africa, and pointed out their characters and geographical distribution. Particular attention was drawn to the affinities of the African *Hirundinidæ* with those of the New World, and also to the representation of various species by smaller races or sub-species throughout the Æthiopian region. Thirty-eight species of swallows were enumerated, of which number thirty were stated to be peculiar to the continent of Africa, and two to Madagascar and the adjacent islands. Two species only were common to India and Africa, and the remaining four were migratory throughout the Palæarctic and Æthiopian regions.

Dr. O. Finsch, C.M.Z.S., communicated the description of a new species of penguin in the collection of the Counts Turati of Milan, which he proposed to call *Dasyrhamphus herculis*.

Messrs. P. L. Sclater and O. Salvin read descriptions of seven new species of birds collected by Dr. Habel during a recent expedition to the Galapagos Islands. These new species were mostly from Bindloes Island and Abingdon Island, which had not been visited by former explorers, and belonged principally to a peculiar group of *Fringillidæ*, containing *Geospiza* and its allied forms, which is characteristic of the Galapagoan Archipelago.

Mr. P. L. Sclater, F.R.S., read a paper on some new or little known species of South American birds, amongst which was a new woodpecker, proposed to be called *Melanerpes pulcher*, from New Granada.

Professor Flower, F.R.S., communicated some additional notes on the specimen of the common fin whale (*Physalus antiquorum*) recently stranded in Langston harbour.

Professor Newton read a paper "On *Cricetus nigricans* as an European species," and exhibited a specimen of this mammal, which had been lately killed in Bulgaria by Mr. T. E. Buckley, F.Z.S., and had been presented by him to the Cambridge Museum.

ASTRONOMICAL SOCIETY.

May 13th.—W. Lassell, Esq., president, in the chair.—Messrs. J. D' Perrins, C. H. Gutty, and E. Dent were elected Fellows.

The following papers were read:—"On some Photographs taken during the Total Solar Eclipse, August 7th, 1869," by Commissioner Aske. "Further observations on η Argûs," &c., by Mr. Abbott. "On an Early Telescope by G. Compani," by Mr. Williams. "On the Determination whether the Corona is a Solar or a Lunar Phenomenon," by Mr. Seabroke. "On Jupiter's Satellites," by Mr. Severn. "Occultation of Saturn, April 18th, 1870," by Mr. Joynson, Mr. Tolmage and Captain Nobb. "On the Visibility of Star Groups considered as a Test of Distance," by Mr. Proctor. "On the Proper Motion of Groombridge, 1830," by Mr. Lynn. "Comparison between the Places of the Tabulæ red and the Radcliffe Catalogue, 1870," by Dr. Wolfen. "Note on the above Paper," by Mr. Stone. "On Meteorological Observations at Gibraltar," by Lieut. Brown. "Observations of Occultation of Saturn," by Mr. Airey. "On η Argûs," by Mr. Severn. "Loi de Mouvement de Rotation des Planètes," by M. Flammarion. "Note respecting the Corona," by Professor Secchi, and "Observations at Colebyfield," by Mr. Penrose.

ANTHROPOLOGICAL SOCIETY OF LONDON.

At the meeting held on Thursday, the 19th instant, at St. James's Hall, Dr. Berthold Seemann, V.P., in the chair, Mr. Henry F. Chorley, read a paper on "Race in Music." The author, after remarking on the vast extent of the subject to be treated in so small a compass, proceeded to point out the difficulties that stand in the way of determining what is and what is not national music, the chief difficulty consisting in the inaccuracies of notation. Notation being comparatively a modern art, and being also the only means by which musical ideas can be transmitted, we are very much in the dark as to the advances made by the ancients in the art of music. Confining himself chiefly to the modern development of music, Mr. Chorley argued that new and original melody is far less common than is generally supposed. By the simple variation of *tempo*, implying some change in accentuation, a melody can be so entirely transformed as to lose its original character. Genuine, fresh national music, again, is comparatively rare, and its character has always been most marked whenever intercourse has been most restricted. Passing from the more limited subject of national music to the broader question of race-elements in music, the author illustrated the great distinction which exists between the Asiatic and European development of the art. In the former it is confined to rhythm, and seldom includes beauty of sound or symmetry of form. In strong contrast to the Oriental ideas of music were cited those of the North of Europe—in Norway, Sweden, Denmark, and Russia. It was the opinion of the author that these people take the highest place as melodists. The fact was pointed out that, with few exceptions, those Northern airs are in minor keys, which might be taken as an expression of, rather than a protest against, the gloom of the climate and scenery, were it not that the same characteristic largely obtains among inhabitants of the torrid zone. The sense of musical rhythm seems as distinctly marked amongst different peoples as varieties of physiognomy. For instance, the Peninsular melodies are only characteristic when they are in triple time, the airs in common time being essentially mawkish and pointless, owing such individuality as they have to the sleepy, voluptuous delivery of the executant. On the other hand, the music of France lies essentially in the direction of squared music—towards what is piquant, as distinct from what is undulating. In treating of the subject of race in music the author could not but direct attention to a phenomenon which is of universal recurrence, viz., the demonstration, not merely of race, but also of sex, in the art, be its stages of culture or civilization ever so primitive or ever so mature. The absence of musical inventive genius in woman is most curious and inexplicable, and affords another signal illustration of the contradictions and inconsistencies which mark music beyond any other art. While women have achieved distinction and often great success in literature, painting, sculpture, architecture, and science, and while they are unsurpassed as interpreters of the drama and of the art of music, not a solitary female composer of originality, or even of repute, is known to the historical or critical observer.

The paper was ably illustrated on the pianoforte by Mr. Dannreuther.

INSTITUTION OF CIVIL ENGINEERS.

May 17th.—Charles B. Vignoles, Esq., F.R.S., president, in the chair.—The paper read was "On recent Improvements in Regenerative Hot-blast Stoves for Blast Furnaces," by Mr. E. A. Cowper, M. Inst. C.E. The author stated that when, in 1828, the late Mr. J. B. Neilson (M. Inst. C.E.) introduced the plan of heating the air employed as blast, by means of iron pipes placed in or near a fire, the increase of temperature was at first only from 60° to 100° Fahr. Subseqnently, Mr. Neilson obtained a temperature of 600° or 650°, and the pipe stoves had since been urged up to 900°, and in a few cases to 1,000°. The wear and tear, however, with such temperatures of blast were considerable, there was great loss of heat by conduction, and the pipe stoves were as a rule worked in a leaky condition, necessitating the expenditure of engine power for blowing air uselessly.

The improvements described in the paper were based upon Mr. Siemens' regenerative furnace, and were minutely detailed by the author.

LECTURES AT THE ROYAL INSTITUTION.

Professor Blackie, in his closing lecture on Moral Philosophy, stated that Utilitarianism is generally a method of thinking, which, while professing to clear up dim ideas, brings confusion and disorder into every region of human thought and action; and specially—1. Which, by deriving thought from mere sensation, by deducing the one from the many, instead of the many from the one, and thus reducing mind to a mere blank impressibility, confounds the essential distinction between necessary and contingent truth, and renders all science impossible. 2. Which, by confounding causation with sequence, pulls up philosophy by the roots, and disembowels theology of all substance. 3. Which, in the realm of the fine arts, for the eternal harmonies and congruities of eternal reason, substitutes the arbitrary associations of ephemeral fashion, local habit, and individual conceit. 4. And which, in the all-important science of human life, transforms morality from a manifestation of true expression, pure emotion, and lofty purpose, into a low consideration and a slippery calculation of external consequences—a philosophy of life, exact and minute, more than enough in certain small and accessory matters, but which, in all great and vital and essential matters, is narrow, meagre, and utterly blank; and which, by systematically divorcing itself from the fervid fountain-head of all moral inspiration, and standing apart, not only from Christianity, but from even the common breath and fragrance of natural human piety, has proved itself utterly incapable of producing those regenerative effects on human society, of which lofty, God-inspired passions, and not peddling analysis and prudential calculations, are the cause!!

Professor Tyndall, in his fourth lecture on electricity, showed the identity existing between frictional and voltaic electricity. His experiments were of special brilliancy, on account of the great battery power used. Mr. C. F. Varley's 1,000-cell Daniell's battery, in connection with 50 of his condensers, produced the usual phenomena of the Leyden jar. His apparatus, known as the artificial line between London and Australia, was also exhibited. The lecturer mentioned Musschenbroek's declaration regarding the shock from the Leyden jar, or rather Kleist's flask—namely, that he would not receive a

second for the crown of France. Mr. J. Cottrell, Professor Tyndall's able and willing assistant, performed the task, receiving the applause of the audience in exchange.

Professor Robert Grant delivered his fourth lecture on the Astronomy of Comets last Saturday afternoon. His explanations are clear and comprehensive, and not without interest. The smallness of the masses of comets and the remote danger of our globe coming in contact with one of them were dwelt upon. The next lecture on Saturday will comprise the comet of 1744, with its singular form of tail; Donati's comet of 1858; and the comet of 1811, one of the most splendid of which history makes mention.

BRISTOL MICROSCOPICAL SOCIETY.

May 8th.—Mr. W. J. Fedden, president, in the chair. The minutes of the last meeting were read and confirmed.

Two new members were then elected by ballot, and three gentlemen were proposed as candidates to be balloted for at the next meeting.

Mr. T. H. Yabbicom, C.E., then read a paper on "Raphides."

Dr. Henry Fripp exhibited and described a peculiar form of dissecting microscope, made by Zeiss, of Jena. The instrument possesses many peculiar advantages, and was much admired by those present.

Mr. F. R. Martin also exhibited Mr. Browning's new portable microscope.

LEEDS PHILOSOPHICAL AND LITERARY SOCIETY.

The annual meeting—being the close of the fiftieth session of the Leeds Philosophical and Literary Society—was held on the evening of May 3, Dr. Heaton, the retiring president, in the chair. Scrutineers having been appointed to go over the voting papers nominating office-bearers, Mr. T. Wilson (one of the honorary secretaries) read the report. It stated:—

The council have much pleasure in congratulating the society on its present condition and prospects. During the past year fifty-three new members have joined its ranks, while the losses by death and otherwise have been only eighteen. The accounts also which accompany this report show that its pecuniary position is not unsatisfactory. The present annual meeting is of no ordinary character, but marks the close of the first half century of the society's existence, and seems to invite something more than the usual statement of its present numbers and financial position, suggesting rather the inquiry how far it has accomplished the objects for which it was founded, and perhaps inviting a consideration of what shall be its action for the future. For the past, the council trust that the society will agree with them in thinking that the review of what has been accomplished, though it may reveal some failures, is, on the whole, eminently satisfactory, and that if it has not achieved everything that its promoters hoped, it has undoubtedly, in many respects, exceeded their most sanguine expectations. When, in the year 1818, its founders met to recommend the establishment of a society in Leeds for the promotion of literature and science, they could scarcely, even the most sanguine of them, have anticipated that, at the end of only half a century, the society would have twice, if not three times, outgrown the provision which the liberality of its townsmen had made for its accommodation, and that it would be possessed of one of the finest and most capacious buildings that any provincial society enjoys, still less that it would have accumulated in its library and museum so rich a collection of books and specimens in illustration of every branch of natural history, and that in some of its departments its museum would be unequalled by that of any provincial society, for the completeness of which it is indebted to the ready munificence of its townsmen, evoked and guided by the knowledge and untiring energy of its curator, Mr. Denny. The Leeds Philosophical and Literary Society claims with pardonable pride to have been the first institution of the kind in the county of York; and it rejoices to know that kindred societies have since been established, and have flourished, with more or less of success, in York, Hull, Sheffield, Halifax, Bradford, Whitby, and Scarborough, and have contributed largely to a taste for the cultivation of natural history, as well as in no inconsiderable degree to its advancement and completeness, by the various collections they have formed of the zoology and geology of their respective districts. It was doubtless anticipated by the originators of the society, in conformity with the practice of similar institutions elsewhere, that much of its time would be occupied with papers on the natural history of the neighbourhood, and that it would be principally occupied with the investigation of the local geology and of the fauna and flora of the district. Many circumstances have contributed to the non-fulfilment of this expectation, and to the attention of the society being directed to other objects. Experience has shown that papers of this kind, being necessarily occupied with technical details, are little calculated to interest a miscellaneous audience; while the establishment of societies and of publications specially devoted to some particular branch of natural history or philosophy, has attracted to them, in preference, all communications from the students of their particular science. The result has been to leave to such societies as ours rather the popularisation and dissemination of knowledge than its local investigation; and it will be found accordingly that a large and increasing proportion of the lectures delivered before the society have been of this character. There can be no doubt that in this way the society has properly ministered to a growing popular want; and it may be expected, as a result of the increasing desire for scientific knowledge among all the classes of the community, that their action will be drawn more and more in this direction. The same tendency of modern education in the direction of science points to the desirableness of increasing, if possible, the facilities for access to the valuable collections of the society, and to the endeavour to render them more and more available for public instruction. Something has already been attempted in this direction by throwing open the museum at a very low charge during the day; and the numbers who avail themselves of this privilege may be taken as an indication that the boon is not undervalued. Reference was then made to the operations of the society during the session 1869-70, and the report afterwards gave the following account of recent additions to the museum:—The various collections of the society have received many valuable contributions from its friends and members during the past year. In geology, the carboniferous system has had a large accession of more than 200 specimens, illustrative of the mountain limestone of Settle, from the well-known collection of Mr. Barrow, presented by Messrs. J. G. & Arthur Marshall; and of several bones of the Solitaire of Rodrigues, presented by Professor Newton, of Cambridge. In zoology, the society may be congratulated on the acquisition of several specimens of the greatest rarity and novelty. Foremost among them is the complete skeleton and a stuffed specimen of the *Picheciago chlamydophorus truncatus*, from Mendoza, in the Argentine Republic, presented by Mr. Henry E. Woods and Dr. Day. The importance of this addition to the class Edentata may be estimated from the fact that the various European museums contain only about eight specimens, some of which are imperfect, and that the animal is considered to be nearly extinct. Another illustration of the same group is the skeleton of the little ant eater, *Cyclothurus Didactylus*, presented by Mr. Thomas Nussey. In addition to these may be mentioned the great articulated skeleton of the Capybara, or water hog, of South America, and the snapping turtle, by Mr. Ryley Briggs; the skeleton of *Apteryx australis*, by Dr. Heaton, the president; stuffed specimens of those rare birds, Owen's Apteryx and Strigops, Habroptilus or ground parrot, from New Zealand, and the skeleton of the Douroucouli, by Mr. J. Metcalfe Smith; a skeleton of the *Loris gracilis* and *Nycticebus Javanicus*, by Mr. Nathan; the singular animal, the racoon dog, by Lord F. Cavendish; the skull of *Elasmognathus Bairdii*, by Mr. Alderman Carter, M.P.; the hairy-nosed Wombat, by Mr. Joseph Craven; a valuable contribution, by Mr. Gellibrand, of Tasmania, consisting of skins and skeletons of *Thylacinus Cyanocephalus*, *Sarcophilus Ursinus*, the Ornithorynchus, the Dasyurus, and several immature specimens and a series of skulls of the above-named animals. To the above, which have all been presented, must be added several species purchased by the society, embracing Cuscus, Hemigallago, Macrocelides, Centates, Ericulus, &c., and the skeleton of an alligator 10 ft. in length. In the archæological and ethnological departments, additions of more than ordinary interest have been made, embracing eighty valuable bronze implements, consisting of swords, palstaves, fibulæ, armlets, torques, bells, &c. from the bogs of Ireland and Italy, purchased by the contributions of several members of the society. Also a series of Saxon, African, and *Asiatic crania*, presented by Sir Charles Hugh Lowther, Bart.; two human skulls, and a variety of native manufactures of the Sandwich Islands, from the Rev. C. G. Williamson; the skeleton of a native Indian from the banks of the Essequibo; skeletons of a sloth and alligator; a collection of insects; and an extensive series of fruits, seeds, gums, and articles of apparel, presented by the Rev. J. Farrer, of British Guiana; a pair of ancient shoes and a human skeleton, obtained from a peat moss in Austwick Common, near Clapham; several coins, bronze spear-head, Unguentain, &c., presented by Mr. Farrar, of Ingleborough House; and an extensive series of primitive flint implements, from Bridlington. The council invite attention to a great improvement in the zoological museum, introduced by the honorary curator of that department, Mr. E. Atkinson. In order that the Mammalian collection may be classified in accordance with the views most generally adopted by zoologists, both in this country and abroad, an entire rearrangement of the specimens has been carried out, at the same time that a tabular chart has been prepared exhibiting at one view the different families and orders of the class, and to each case has been attached the characteristic features of the groups of animals it contains. This popular guide for the visitor will, it is hoped, aid those who are wishful to acquire a more intimate knowledge of the various modifications and structural affinities of those parts of the animal kingdom which the large room, specially appropriated to this class, is so well adapted to exhibit in juxtaposition. The library has received the various transactions and reports of many of the principal societies at home and abroad, besides many valuable publications by public bodies and pri-

vate individuals, amongst which they would especially record 64 vols. of catalogues of the National History Collection and Ancient Inscriptions, Papyri, and Marbles in the British Museum. These have been presented by the trustees of the British Museum. At the conclusion of last year's report a suggestion was thrown out that it might be productive of some benefit to the society, as also a pleasant reunion, if some meeting of the old and new members could be arranged, to commemorate the termination of the fiftieth session; in accordance with which a commemoration dinner took place yesterday at the Great Northern Station Hotel, presided over by Mr. Baines, M.P., one of the original founders.

On the motion of Dr. Chadwick, seconded by Mr. Ikin, the report was adopted, and ordered to be printed and circulated. Thanks were voted to the retiring officers, on the motion of Mr. F. M. Lupton, seconded by the Rev. J. H. M'Cheane; and afterwards, on the motion of Dr. Greenhow, seconded by Mr. Atkinson, a similar compliment was accorded to the gentlemen who have read papers during the year. It was then announced that the following gentlemen had been elected as officers, council, and members for 1870-71:—Officers—President, John Deakin Heaton, M.D., F.R.C.P.; Vice-Presidents, C. Chadwick, M.D., F.R.C.P., Thomas Nunnerley, F.R.C.S.; Treasurer, Henry Oxley; Honorary Secretaries, Thomas Wilson, M.A., Richard Reynolds, F.C.S.; Honorary Curator in Geology, J. G. Marshall, F.G.S.; Honorary Curators in Zoology, Edward Atkinson, F.L.S., T. C. Allbutt, M.A., M.D., F.L.S., F.S.A.; Honorary Curator in Ethnology and Works of Art, &c., Thomas Nunnerley, F.R.C.S.; Honorary Librarian, John Deakin Heaton, M.D., F.R.C.P. The above officers and the following gentlemen compose the Council:—John Edwin Eddison, M.D., E. Filliter, M. Inst. C.E., F.G.S.; T. M. Greenhow, M.D.; Joshua Ingham Ikin, F.R.C.S.; Rev. J. H. M'Cheane, M.A.; John Manning; T. W. Stansfeld; Rev. H. Temple; William Sykes Ward, F.C.S.; Rev. Canon Woodford, D.D.; General Curator and Assistant Secretary, Henry Denny, A.L.S. This concluded the business.

ARMAGH NATURAL HISTORY SOCIETY.

The May monthly general meeting of members was held in the Library on last Wednesday evening, the Rev. John Armstrong in the chair. The minutes of the previous meeting having been read and approved by the chairman, the Rev. Messrs. Dobbs and Armstrong were elected members, and Mr. William Magowan was proposed and seconded for admission.

Mr. Mills, LL.B., having been called on by the chairman, opened the subject for the evening—"Infusoria"—in his usual masterly style. Having exhibited several curious and most interesting objects with the aid of the society's valuable microscope, consisting of animalcules and the bell-shaped vorticella, he proceeded to explain the structure and peculiarities of these wonderful little creatures in terms simple and easy of comprehension. He explained their singular mode of propagation, viz., multiplication by subdivision; and, at the request of a member, marked the distinction between animal and vegetable life in an interesting manner. Before concluding, Mr. Mills referred to some recent experiments relating to the vexed question of spontaneous generation, but declined to pronounce his own opinion on the subject, which he observed was still unsettled.

A discussion ensued, after which the chairman conveyed to Mr. Mills the warm thanks of the meeting for his instructive address.

Mr. Mills replied by stating the pleasure he felt at all times in placing his services at the disposal of the society.

A member asked the following question during the evening—"How does the cuckoo deposit its egg in the nest of another bird, which nest is smaller than the cuckoo itself?"

The question, though it seems simple, received several incorrect guesses by way of reply.

Dr. Rigg solved the mystery by stating that the cuckoo, having laid its egg in a field, lifts it in her bill and deposits it in the nest.

Another question as to crows preying on smaller birds was answered in the negative.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

Paris, May 16th.—Amongst the papers brought forward at this meeting was one by Dr. E. Decaisne, on "The Sewing-Machine and the Health of Workwomen."

From a close observation of 661 women employed to work at this machine, he concludes:—

1. That the effects produced by working at this machine differ in nothing from those produced by any excessive muscular work which exercises certain limbs, to the exclusion of all the others. Thus, pains in the muscles, loins, and thighs do not exist in the case of the women who only work two or three hours a day, and cease altogether in a short time with those who work even more.

2. Whilst admitting that excessive work is, with women, a potent cause of derangement of the stomach, it seems to the author to be impossible that the sewing-machine could occasion those digestive disorders to be met with amongst every sixteen out of twenty workwomen of different trades in Paris.

3. He affirms that, if the state of the respiratory organs in women who work at the machine is compared with that of those who work at the needle, the effects will be found to be exactly the same amongst all the workwomen.

4. As to its influence on the nervous system, he does not consider the noise of the machine injurious in any way, as has been alleged; for it is acknowledged by all workwomen that although at first the vibration of the machine occasions them some inconvenience, they soon become accustomed to it, and also that it has no effect whatever on their health. In fine, Dr. Decaisne is of opinion that the sewing-machine as worked by women, when employed within reasonable limits, is not more injurious for the health than work at the needle. That which proves it is this: that amongst 28 women, from 18 to 40 years of age, working from 3 to 4 hours a day at the sewing-machine, it was impossible to find any disorder which might be attributed to its use. M. Decaisne, by the conclusions which he has drawn from a close observation of the use of the sewing-machine, refuted some of the objections made with regard to it; but he overlooked altogether the gravest side of the question, which is, that most of the women employed at those machines work, not from 2 to 3 hours, but from 12 to 15 hours a day; for it is only by this excessive work that sewing-machines become remunerative to them and their employers. Dr. Decaisne thinks that in selecting a machine it is best to employ those in which the pedals are worked isochronously, and not alternately.

M. Raoul, Professor in the Faculty of Sciences at Grenoble, brought forward a paper on gas emitted from a hot spring. It is nearly pure marsh gas, containing of this quite 99 per cent.; the rest being composed of carbonic acid and elements of air.

M. Dumas analyzed a work by Dr. Frankland, on the purification of the water of sewers.

M. Belgrand presented the Academy with a work containing a geological history of the Paris Basin.

M. Fizeau read a paper, which was called forth by a communication recently made by Father Secchi on the displacement of the spectral bands, caused by the relative vibration of the earth and the stars.

M. Regnault presented a note by M. Rosetti relative to the influence that alcohol added to water has on the temperature of the maximum of density and on the point of congelation.

M. de Averzac presented a publication by Father Bertelli on the history of the compass.

M. Dumeril presented, on the part of an anatomist, a remarkable work on the pancreas of fishes.

M. Peligot read a letter from a correspondent at St. Louis, on the use of milk as a preventative against lead poisoning.

The meeting was then brought to a close.

NOTES AND MEMORANDA.

The Sulphur Beds of California.—Sulphur has been chiefly supplied from the sides of Mount Etna, in Sicily, but the works on the shore of Clear Lake produce now 4 tons a day. The Sicilian brimstone costs in California 4 cents per lb., but the domestic article is sold for 3½ cents. Clear Lake occupies the crater of an extinct volcano, and the evidences of volcanic action abound in the vicinity. Within a triangle of about 25 miles to the side there are volcanic scoria, trap, lava, obsidian, tufa, warm springs, and other remains of eruptions, with signs of subterranean heat not far from the surface. The sulphur bed of Clear Lake consists of a bank resembling ashes, containing numerous alkaline and sulphur springs with vent-holes, from which sulphurous fumes escape. Pure sulphur crystals deposited from the fumes surround these holes. The earth, containing about 50 per cent. of sulphur, is placed in an iron retort heated to a high temperature, so that the sulphur is driven off in fumes into a receiver, where it settles in a liquid form, and runs out into pine boxes 2 ft. long and 1 ft. square. The lump sulphur is used chiefly for making powder and sulphuric acid, which last is employed in making blue-stone, giant-powder, nitric acid, and muriatic acid, and in refining gold and silver. The consumption of sulphuric, nitric, and muriatic acids on the coasts amounts to 2,000,000 lb., and the entire demand is supplied by home manufacture. Flowers of sulphur have also been produced at Clear Lake. The fumes passing off from the retort are in this case led into a large cool chamber, where they condense into a flaky snow-like condition.

Medical Science at the Royal Academy.—The *British Medical Journal* gives the following critique:—Medicine and medical men are by no means badly represented in the Academy this year. It may not be out of place, therefore, specially to direct the attention of our readers to the fact, and to enumerate the chief objects of medical interest. In gallery No. 1 is an excellent half-length portrait of Mr. James Shaw, late Principal Inspector-General, Medical Department Madras Army, painted, at the request of his friends, by J. Sant, R.A. In gallery No. 4 is the remarkable picture of Sir Edwin Landseer—the Doctor's visit to poor relations at the Zoological Gardens—to which we recently allnded. In gallery No. 7 is a portrait, sitting, of Dr. Bird, by E. A. Gifford; in gallery 10, a water-colour of the Library and Museum now being erected for the governors of the Sussex County Hospital, and of the projected buildings proposed to complete the design, by E. E. Scott; a portrait, almost full-length, of John Boutflower, Esq., presented by public subscription to the Salford Royal Hospital, by H. Measham; "A Widow's Mite," by J. E. Millais, R.A., a melancholy painting, representing a rather emaciated young woman in weeds dropping a copper into a subscription-box, the evident connection between which and the Hospital for Consumption, Brompton, will, it is hoped, be apparent in the next annual report of that hospital. In this gallery may also be seen an oil landscape of very considerable merit, representing Rotterdam in the distance—"late afternoon, August, 1869, showery weather, a vacation study"—from the brush of our associate, Sir Henry Thompson. Adjoining is a fairly good portrait of Sir Thomas Watson, Bart., by S. Lawrence. In the central hall a medallion of Dr. Francis Shortt Arnott, by A. B. Wyon, is exhibited. The vestibule, again, is rich in medical busts. Among them are a very good likeness of Dr. Quain, by E. Davis; an excellent subscription bust of the late Mr. Goodsir, to be placed in the Edinburgh University Library, by W. Brodie, R.S.A.; and a no less successful subscription bust of Professor Christison, by the same sculptor, a duplicate of which is to be placed in the same library. There is also a bust of Dr. Sheridan Muspratt, by J. Adams Acton. In the vestibule may be seen a medallion of Dr. Neil Arnott, by A. W. Wyon; and a medal struck for the Royal College of Physicians in memory of the late Dr. Baly, and executed by J. S. and A. B. Wyon. There are numerous other objects of special interest to medical men, but those which we have mentioned are the most important.

Lighting Mines by Gas.—At the Royal Institution of Cornwall annual meeting, on Wednesday, Mr. W. J. Henwood, the president, said that in Sweden at the beginning of this century, and in Himalaya some fifteen years ago, the miners obtained light (and were sometimes almoft suffocated) when at their work by smoky flames from burning splinters of resinous pine. In Brazil, oil expressed from nuts of the *Palma Christi* is commonly used by the miners. An experiment made at Balleswidden, near Penzance, during several months of 1856-7, attracted at the time much less attention than might have been expected, and is now almost forgotten. Coal gas was made on the surface, and conveyed down one of the shafts to a depth of more than 120 fathoms through a 2 in. wrought-iron pipe, from which branches, varying from ¾ in. to 1 in. in diameter, were laid—in some cases for at least 170 fathoms—along the several (levels) galleries; and similar tubes extended, occasionally as much as 10 fathoms above the levels, to the various (backs or pitches) parts in progress. Flexible pipes of gutta-percha were, on occasions, carried to individual labourers, but, where four men worked together, a single jet of gas gave light enough for them all. The captains of the mine reported that—"In the shaft, levels, and pitches it answered so exceedingly well as to leave no doubt of its serving all the purposes for which it was intended. It was computed that the works were lighted by gas one-third cheaper than by candles.

SCIENTIFIC DIARY.

WEDNESDAY, May 25th.

Society of Arts, 8 p.m. The Paper by Mr. Willis, "On the New Organ in the Albert Hall of Arts and Sciences," is postponed. "On Gold Mining and its prospects in Nova Scotia, embodying the results of Geological Surveys of the Districts of Waverley and Sherbrooke for the Provincial Government," by Henry Youle Hind, M.A.

Geological Society, 8 p.m. "On the newer Tertiaries of Suffolk and their Fauna," by E. Ray Lankester, Esq.; communicated by Prof. Huxley, F.R.S., F.G.S. "On the Distribution of Wastdale Crag Blocks, 'Shapfell Granite Boulders,' in Westmoreland," by Prof. R. Harkness, F.R.S., F.G.S. "On the Superficial Deposits of the South of Hampshire and the Isle of White," by Thos. Codrington, Esq., F.G.S. "Notes on an ancient Boulder-clay of Natal," by Dr. Sutherland; communicated by Prof. Ramsay, F.R.S., F.G.S.

Royal Society of Literature, 8 30 p.m.

Archæological Association, 8 p.m.

THURSDAY, 26th.

Society of Antiquaries, 8.30 p.m.

Zoological Society, 8.30 p.m. "On Dinornis (Part XVI.), containing notices of Internal Organs of some species, with a description of the Brain and some Nerves and Muscles of the Head of *Apteryx australis*," by Prof. Owen, F.R.S. "Notes on the Anatomy of the Prongbuck (*Antilocapra americana*)," by Dr. J. Murie. "Some remarks on the Poison Glands of the genus Callophis," by Dr. A. B. Meyer. "Notes on some Fishes from the Western Coast of India," by Surgeon Francis Day.

Philosophical Club, 6 p.m.

London Institution, 7.30 p.m.

Royal Institution, 3 p.m. "Electricity," by Prof. Tyndall.

FRIDAY, 27th.

Royal United Service Institution, 3 p.m. "Military Hygiene," by Dr. F. de Chaumont.

Royal Institution, 8 p.m. "Primitive Vegetation," by Principal Dawson.

Quekett Club, 8 p.m.

Clinical Society, 8.30 p.m.

SATURDAY, 28th.

Royal Botanic Society 3.45 p.m.

Royal Institution, 3 p.m. "Comets," by Prof. Grant.

SUNDAY, 29th.

Sunday Lecture Society, 3 p.m. "On Ancient Teutonic Mythology," by Karl Blind, Esq.

MONDAY, 30th.

Society of British Architects, 7 p.m.

Asiatic Society, 3 p.m.

London Institution, 4 p.m.

National Association for the Promotion of Social Science, 8 p.m. Report on the "Habitual Criminals' Act."

TUESDAY, 31st.

Royal Institution, 3 p.m. "Present English History," by Prof. Seeley.

Institution of Civil Engineers, 8 p.m.

Anthropological Society, 8 p.m. "On the Armenians of Southern India," by Dr. John Shortt. "The Races of Morocco," by John Stirling, Esq., M.A.

National Association for the Promotion of Social Science, 8 p.m. Consideration of the "Prisons Act, 1865," and the "Industrial Schools Acts."

WEDNESDAY, June 1st.

Obstetrical Society, 8 p.m.

Ethnological Society, 8.30 p.m. "Report on the Prehistoric Antiquities of Dartmoor," by G. Spence Bate, Esq., F.R.S.

THE PHYSIOLOGY OF THE BICYCLE.—"T. A. O."—Thanks. We have done as you wished.

BOTANICAL FIGURES.—"T. M."—We are much obliged to you for the order kindly sent.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.—"T. W. W."—Thanks for the report received.

GEOLOGICAL DREAM ON SKIDDAW.—"J. C. W."—We are sorry that any such misinterpretation as that you suggest should have occurred. The pamphlet shall be noticed in an early number. Send us anything else you may write in future. We shall always be glad to further your views.

MR. PROCTOR'S MAPS.—"A B."—The fact you state was mentioned in our leader on the subject. The map received shall be noticed as soon as possible.

SUNDAY LECTURE SOCIETY.—"W. H. D."—Our reporter was evidently mistaken. We are glad to do anything in our power to aid your society. Make the ticket of admission for two instead of one.

BOOK OF BIRDS.—We beg to thank Messrs. Cassell. We cannot, however, comply with the somewhat singular request in their letter. They may, nevertheless, rely on us thoroughly.

THE MODERN PLAYMATE.—"Inquirer."—The book has not yet reached us. We hope soon to notice it, and point out its many good qualities.

ROYAL INSTITUTION OF CORNWALL.—Report has reached us.

DRESSING FEATHERS.—"R. G."—We await your communication.

ANIMALS AS FELLOW-BOARDERS.—"G. C. B."—We thank you for thinking of us. The facts, however, referred to are too well known to zoologists to merit any special mention on our part.

WEDNESDAY, JUNE 1, 1870.

THE GOVERNMENT AND DR. LIVINGSTONE.

THE British Government, in the very enthusiasm of munificence, has actually contributed £1,000 towards the rescue of Livingstone from his present perilous position! We suppose that we should be thankful for small mercies, and ought to express our gratitude to the Ministry for its nobleness of heart in thus expending so vast a sum, and in sacrificing that sublime principle of "self-support," which is the pride and glory of the Chancellor of the Exchequer. But, somehow or other, we are not grateful for this benefit; and we see in it little more than the spirit which induces an opponent of the individual eleemosynary system to give a penny to a more than usually pertinacious mendicant. The Geographical Society, through its kind-hearted old President, has pressed Livingstone's claims so strongly, both on the Government and on the public, that the former could not, from a sheer desire to consult its own comfort, do less than give the small gratuity it has offered on behalf of the great missionary traveller. Livingstone's name is a household word in every British home; and to refuse to aid in securing his rescue from the dangers and trials that now encompass him, would be to lose the popular voice on which the present Government relies for so much of its strength. In the minds of the masses £1,000 seem a large sum to contribute towards the expenses incurred in the release of an African traveller, and the gift will thus enhance the favour with which the Ministry is now greeted by the people. But those who know anything at all about the difficulties and costliness of travel on the African Continent can form some idea of the insignificance of this sum, as compared with the expenditure to which the good and brave old missionary will necessarily be subjected. We can only trust—as, indeed, was apologetically expressed by his Grace the Duke of Argyll—that our countrymen will not gauge either their charity or their estimate of geographical labours by the views of the British Ministry, but will give with an open hand and cheerful heart toward the fund requisite to insure the safe return of a traveller who has not only "spread the truth," in the missionary sense, abroad; but who, unlike the great host of African travellers, has *told* the truth at home. If money should be wanted to secure the return of one of the most self-sacrificing, honest, and single-hearted travellers that the age has produced, it will be a lasting disgrace to the country to whose literature and science Livingstone has contributed so well and so largely.

While on this subject, we must express our astonishment at at the somewhat inconsistent course which the Government has in this case pursued. If Ministers are prepared—as they pretend to be—to swear by the principle that they should contribute toward the support of nothing which voluntary effort may suffice to maintain, why then did they grant any sum toward Dr. Livingstone's return? If the gift was not merely a sop to the Cerberus of popular opinion, on what plea can the Government justify it? It cannot be on the principle that science should receive aid from the State; for already Mr. Lowe has expressed himself as distinctly of opinion that the Nation alone has to do with the encouragement of scientific work. Was it in connection with the extension of missionary influence?—and, if so, is not Church disestablishment in Ireland rather an anomaly? Or, lastly, is it the fact that Mr. Lowe's opinions do not pervade the whole Council; and that there are others among the Ministry who, not being interested in the legerdemain of the Budget, think that State money cannot be better laid out than in encouraging the labours of those whose whole lives go towards enriching in prospective that exchequer which denies them even the most trifling assistance in the present? Surely this must be the explanation of the remarkable anomaly which the Ministry have perpetrated in giving £1,000 towards Livingstone's expenses.

We could wish, did space permit us, to say a word or two on the principle which is supposed to influence the *liberal* Government in regard to aid to Science; but we must defer its discussion to some future occasion. In the mean time, however, does it not remain to be shown in what respect, in reference to their relation to the State, Pauperism and Science differ? The former is far more likely to be provided *against* by voluntary aid than the latter is to be provided *for*. Yet, put it how we may, we cannot in the least doubt that, for all practical purposes, the Poor-law Board and the Poor-law system are part and parcel of the State; and it is the State, and not the Nation, which provides for the relief of the poor. When shall we have a Central Board to provide for the poor of Science; to help those hardworking and enterprising men who, with small means at their disposal, spend their little all in the pursuit of those researches which unfold to them the great secrets of the universe, and which develop those industrial resources which make England the prosperous country that it is?

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

WE beg to say that Mr. T. Cooper, who—on the authority of a contemporary—we recently stated was on his way home from Bombay, has been for some weeks in England, where he intends to remain for a time, with the twofold object of recruiting his health and preparing for the press the results of his last two-and-a-half years' travel. There is, we are authorized to state, no foundation for the rumour that the Geographical Society is contemplating Mr. Cooper's employment on another expedition.

WE are authorized in stating that, should the Government, as suggested by a contemporary, propose to Parliament to erect the new Natural History Museum on the site occupied by the Exhibition of 1862, the proposal will meet with very grave opposition. The question will probably be taken up during the present session.

THE days of bitter personal rivalry between journals are happily dying out, and instead of the invective with which opposing editors used at one time to assail each other, we now find a wholesome and Christian regard for his neighbour pervading the editorial mind. This is aptly illustrated in the recent conduct of the *Lancet*, in its treatment of its old adversary, the *British Medical Journal*. The *Lancet*, with a generosity unequalled in the annals of journalism, has been trying to develop the advertising department of the *British Medical Journal*. With this view it points out to the public that the *Journal*, besides its general sale, has a list of subscribers among the leading members of the profession, numbering *three thousand three hundred and six*, and that the revenue from its advertisements is so large that "from this source nearly the whole of the working funds of the [British Medical] Association are derived." We congratulate our contemporary on the admirable spirit it has displayed, and we commend its conduct to the consideration of journalists generally.

WE understand that the House of Representatives at Washington, U.S., have appropriated $100,000 in aid of the Arctic expedition. It is said, too, in reference to the French

[illegible] that the money required has at length been raised and it is hoped that the [illegible] from Havre in a few days.

At the meeting of the Royal Botanic Society, held last [illegible] Mr. [illegible] Turner, vice-president, in the chair, nineteen candidates were balloted for and elected fellows, and the names of several additional candidates were read. The list of donations since the last meeting included plants of [illegible] from Portugal, trained in a manner peculiar to that country.

The French correspondent of the [illegible] is responsible for the following story:—In the private apartments of the Emperor's palace, it is related that a lady [illegible] in fact—went near a [illegible] and again approached—a new shock, and sharp prick. [illegible] was impossible; however, she would try the experiment again. The [illegible] was increased in energy and the prick became painful. Whatever was the matter? and calling several persons of her suite, she said, "Try then," to one of them to whom she related the strange adventure. This lady allowed a slight cry of astonishment to escape her, for she, too, had felt the shock and the pricking. The grand lady then begged her husband to try. He, a little [illegible] but smiling, ventured to the magic mantelpiece. When he was within a few inches from the fireplace a fine jet of [illegible] fire was seen to pass from the marble to his clothes. What was the mystery? They sent off to the Sorbonne for one of the professors—not as in old times; they would have called in a magician. M. Jamin, one of the finest experimenters ever seen at a lecture-table, posted off to the bewitched palace. The mantelpiece received him with showers of characteristic crackling sparks. "Ah! that is electricity," said M. Jamin, and in a few seconds he found the key to the mystery. Before the mantelpiece was a magnificent bear's skin; every time when any one walked upon it the friction generated electricity, which manifested itself in its usual forms of sparks and shocks. M. Jamin rubbed the bearskin, and the sparks multiplied.

The gold and bronze medals granted by the Council of the Royal Geographical Society to successful competitors in an examination confined to the chief public schools of the United Kingdom, have this year been awarded as follows:—Physical Geography: Gold medal to G. G. Butler, of Liverpool College; bronze medal to M. Stewart, of Rossall School. Honourably mentioned: W. Hind, Cheltenham College; G. Hughes, Liverpool Institute; F. J. Beckley, King's School, Sherborne; F.W. Hunt, University College School; R. F. W. Shawe, Cheltenham College; E. C. Thomas, Manchester Grammar School. Political Geography: Gold medal to G. W. Gent, of Rossall School; bronze medal to J. H. Collins, of Liverpool College. Honourably mentioned: Edward Crabb, Manchester Grammar School; W. Grundy, Rossall School; G. Hogben, University School, Nottingham; J. D. Murray, Clifton College; and H. B. Dixon, Westminster School. The medals were presented to the successful candidates by the President, at the anniversary meeting on the 23rd ult. The prizes will be continued in 1871.

The *Gardeners' Chronicle* states that, in a recent communication to the Swiss Alpine Club, M. Alphonse de Candolle suggests the desirability of searching for the remains of that vegetation which existed on the Alps previous to the formation of the glaciers. The Alps, he points out, assumed their present contour and actual height at the end of the Pliocene epoch. The great development of glaciers and snow took place in the subsequent geological epoch. As snow and ice are conservative agents, so he thinks it possible that remains of crustacea, diatoms, seeds, &c., may exist buried in the ice at great depths. Professor Oswald Heer, however, thinks the project a useless one.

It is reported that in Guayaquil, between Point Pasado and Point Venado, a peculiar volcanic movement has taken place. In a space of two leagues the surface of the earth undulated slowly, and great chasms and deep circular excavations were opened. A new lagoon was formed, and between the shore and the sea there appeared a large-sized hill. During all this fearful commotion, the hills along the coast were observed to be in a state of unrest, and large land-slides took place, carrying with them rocks and trees. For four days this agitation continued, the undulation being from west to east.

The Trustees of the American Museum of Natural History, to which we alluded in our last, have published an interesting Report, which they close with an appeal to the public for further assistance; they say that the present subscription list of $[illegible] should be increased to at least $100,000. We also notice, in connection with this, that the Legislature of the State of New York have changed the name of the State cabinet at Albany, and have put it under the direction of Professor James Hall. The Albany geological specimens are typical ones, and are of the utmost importance to the scientific men of the whole country, as they afford the key to the geological nomenclature of the United States. There is, therefore, great wisdom in carefully preserving them and intrusting them to the geologist who has given names to the groups of rocks in the State, and has done more than any other to illustrate and explain the relative position of American formations. The Legislature also authorized the presentation of duplicates to the American Museum of Natural History in New York.

An important discovery is said, by the *North German Correspondent* (quoted in *Public Opinion*), to have been made at Jerusalem. It is an old stone bearing the figure of a god sitting on a throne, with priests on both sides, and a Hunyaritish inscription two lines in length—which had been brought from Yeman, and was offered for sale. Dr. Oscar Meyer, the Chancellor of the North German Confederate Consulate, succeeded in obtaining an impression, which is at present in the hands of the Confederate Consul, Dr. Blau, who is residing for a time at Berlin. The inscription is said to contain the name of "Athtar" (Astarte).

A few weeks ago the Worcester Archæological Club were astonished at an announcement made to them by Mr. Lines, one of the members, of an extraordinary discovery of traces of ancient habitations, on an extensive scale, on the slopes of the Herefordshire Beacon, and also in connection with the smaller camps on Midsummer Hill and Hollybush Hill. An exploratory visit has accordingly been made to the *new* field of research; and Mr. Lines read an elaborate descriptive and theoretical paper on the subject at Midsummer Hill, where he pointed out the peculiar character of the ancient camp on that hill, its convoluted entrance, and the honeycombed depressions of the whole crest, the sides being worked into terraces, and concentric rings or hut circles being visible on the east side, overlooking Hollybush Hill. Mr. Lines, says the *Builder*, pointed out an altar in peculiar relationship to certain triangular tanks, which reminded him of Hindu religious observances, and the water triangle of ancient symbolism. An artificial cave in connection with the remains was also visited, and what he regarded as a tumulus or cemetery, urging its excavation, with permission of the lord of the manor, Earl Somers, who, he thought, would feel as deeply interested in these remains as any member of the club could be.

We understand that there is a vacancy in her Majesty's Office of Works for an assistant surveyor. The salary is £500 per annum, increasing to £700. The First Commissioner, we learn, has determined to receive applications from duly qualified persons, and to deal with them on their merits, without reference to patronage.

In his recent report on the Botanic Garden, Jamaica, Mr. Robert Thomson says, in reference to the coffee and cinchona plantations:—"As the plantations (of coffee) were gradually extended, and the primæval forests disappeared to make way

for more profitable vegetation, the rain-producing agents were removed, and a comparatively dry hilly climate obtained for the new product. Coffee may thus be said to have created its own climate, and it is not presumptuous to predict for the cinchona a somewhat similar history, abounding, no doubt in episodes of disappointment, difficulty, and labour, but recording eventually a great and gratifying success."

We are informed, and we trust that our information is well-founded, that on the next trip which the *Porcupine* is to take, Siemens's electric thermometer will be employed. By this means we shall have a certain record of the temperature at different depths. It will be remembered that, in a leading article which we published nearly a year ago on this subject, we suggested, among other methods of inquiry, some experiments for the determination of the actinic power at various depths. It is satisfactory to learn, therefore, that this idea is to be carried out, and that already an apparatus is being constructed for the purpose.

With the view of arresting the decay of the stone-work in the clock tower in the Houses of Parliament, the Board of Works have given orders for its being coated with Szerelmey's preservative composition, which was applied to another part of the building twelve years ago.

From the report of Dr. Schomburgk, the Director of the Adelaide Botanic Garden, it is evident, says the *Gardener's Chronicle*, that good work is being done in South Australia in the way of introducing serviceable plants, &c. The Sultana vine has been introduced, and succeeds well, but, like the Zante currant grape, will not fruit if short-spur pruned. The system of long-rod pruning, says Dr. Schomburgk, must, therefore, be adopted, and at least eight to ten eyes should be left on every rod. "The Guinea grass, *Panicum giganteum*, also promises well; and if it only grows half as luxuriantly in South Australia as in South America, there would, during the summer months, be an end to all difficulties about green food for cattle." *Cynodon Dactylon* is spoken of as the only grass that will stand the scorching heat and drought of the summer on lawns.

The Committee for arranging the meeting of the British Medical Association at Plymouth in 1871, have decided to nominate Mr. John Whipple, F.R.C.S., as the president for that occasion.

Mr. Proctor's *Star Map*, No. 5, is just issued, and is a most perfect thing of its kind. It is a fac-simile of the photographs exhibited by Mr. Proctor at the Royal Institution, and it—assuming its fidelity to fact, which we cannot doubt for a moment—demonstrates favourably the author's views on Star-drift.

According to the *Builder*, the Report of the Council of the Architectural Museum, about to be issued, states that the Council are now negotiating with the Royal Academy for an exchange of Classic for Gothic work; and with the South Kensington Museum for the loan of nearly 500 casts from Amiens and other places on the Continent and in this country, in return for casts from the Bartle-Frere Indian sculptures belonging to the Council; that the formation of a library of reference for students and art-workmen has been determined upon, the sum of £10 towards the necessary fittings; and, some valuable works having been already promised by Mr. Henry Vaughan, it is hoped that other donations in books, or in money for their purchase will follow.

Sir Thomas Watson is fast recovering, and will soon again resume the preparation of the new edition of his great treatise on Medicine.

Intelligence has been received of the floating dock *Bermuda* having been safely floated into the camber or basin of the royal naval dockyard, at Ireland Island. Preparations were being made for docking in it her Majesty's ship the *Racoon*.

The *Lancet* of Saturday proposes that the Serpentine shall be converted into an artificial sea. There is to be a huge reservoir on the Downs. Water is to be steam-pumped from Brighton to the latter, and then allowed by its own pressure to find its way into Hyde Park. We have no faith in the extensive benefits of salt-water baths, and we cannot but think that Mr. Tidman must have something to do with the *Lancet's* notion. Dominie Sampson would have styled the idea Prodigious! But everything is colossal in these days.

We have received a number of a periodical called the *Carlow College Magazine*, a journal which, among other things, proposes to keep its readers *au fait* of scientific progress. It has an article on modern geology, which is anonymous, but which is couched in such charmingly modest language that we cannot help quoting one of the author's opinions. *Apropos* of Sir Charles Lyell's support of the Darwinian theory, the distinguished geologist of the *Carlow College Magazine* thus expresses himself:—"This coming in of new forms and extinction of others, Sir Charles Lyell, we regret to say, accounts for on the Darwinian hypothesis, and even accepts the theory in its extremest form, as accounting for the origin and development of the human race. He is in this, and in many other respects, especially in the later editions of his works, a very unsafe guide; and his great popularity as a writer, and the unprecedented sale of his works on geology, are among the many signs of the spirit of this unhappy age"!!! We commend the above expression of opinion to the careful notice of those who are trying to oppose the secular system in Ireland, and establish in its place the glorious benefits of denominational education!

During the session just concluded, there have been added to the register of the Institution of Civil Engineers 42 members and 114 associates, while the Council have admitted 56 students. The numbers of the several classes now on the books are 16 honorary members, 703 members, 1,002 associates, and 178 students, or a total of 1,899 of all classes, as against 1,758 at the same date last year, or an increase in the interval of upwards of 8 per cent.

The huge Greenland shark (*Laemargus borealis*), which a few weeks ago was taken off the Bell Rock, and exhibited for two or three days in Edinburgh, has now been stuffed and placed in the collection of British fishes in the Museum. This monster, measuring about 15 ft., is one of the largest, if not the very largest, whose capture is on record, and will doubtless be an object of considerable attraction for some time.

The new buildings for the Natural Philosophy department of the Science Schools at Oxford are nearly complete, and Professor Clifton is gradually removing his apparatus to the rooms prepared for them.

The installation of the new Chancellor of the University of Oxford (the Marquis of Salisbury) will, we understand, take place on the Tuesday before the Commemoration, viz., June 21. A great number of visitors have already arrived at Oxford, which, with the Grand Commemoration in June, and the Royal Agricultural Society's Meeting in July, will be unusually gay and busy.

The statue of Columbus, presented by the Empress Eugenie, had arrived out at Aspinwall.

In the House of Commons on Monday night, Mr. Liddell asked whether there was any objection to lay upon the table, in a compendious form, the results of a series of experimental trials made during the last twelve months on board her Majesty's steamers *Urgent* and *Lucifer*, at Portsmouth, with Welsh and north country coal, and the best form of furnace to be used for the consumption of smoke. Mr. Baxter, in reply,

said there could be no objection to lay upon the table a statement of the result of these experiments, which were of a very interesting character, and were entirely confirmatory of the policy which had been recommended.

At the meeting of the French Legislative body on the 30th ult., M. Jules Ferry drew the attention of the Government to the alarming progress of small-pox in Paris, which last week carried off 209 persons, and which is still increasing. He demanded the introduction of a system of gratuitous vaccination, the removal of the small-pox patients from the hospitals in Paris to the country, and a congress of medical men to consider the means of arresting the epidemic.

Mr. Alex McDowell, of Clifden, West Galway, has made a good find in the so-called Eozoon. It occurs in bunches, not very large, but showing the structure as well as the best Canadian. The Connemara serpentine is interstratified with beds of limestone, dolomyte and chrysotyle.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

ON THE ANCIENT IRON TRADE OF IRELAND.

BY G. H. KINAHAN, M.R.I.A., ETC.

In Three Parts.—Part II.

FURTHER northward, in the Co. Galway, there were extensive works at Woodford; these do not appear to have been specially referred to by any of the old writers. They were erected by the Burkes of Marble Hill; but, according to Dutton, they were last carried on by a Mr. Crossdale.[1] Bog-iron ore was raised in that neighbourhood, and it is said "was mixed with red-mine and ore, that was brought up the Shannon from below Limerick." This appears to have been one of the last furnaces put out in Ireland; for, from tradition, the fire was extinguished in the year 1750. The anvil, hammer, and one of the bars of the furnace are still preserved, and on the latter is the date 1681. This date, Sir T. J. Burke, Bart., the present proprietor of the property, believes to record the time the furnace was erected, while the date given above was that at which the fire was put out, the before-mentioned furnace at Whitegate having been extinguished forty or fifty years prior to it.[2]

To the west of this county there are also traces of the old iron trade; for north-west of the town of Galway, and southward of the village of Oughterard, near Killaguile, are the ruins of an old iron furnace. Tradition says that the ore was raised in the hilly country further south, near Spiddal, but carried here to be smelted on account of the woods that then existed. In favour of this tradition it may be mentioned that, in the country northward of Spiddal, much bog-iron-ore was observed. On the north-eastern end of Camus or Screeb Bay, which is one of the inlets extending out from the archipelago on the north of the mouth of Galway Bay, there is another old furnace, in the vicinity of which a quantity of wood-charcoal and a mass of malleable iron were observed. This locality does not appear to be a favourable place in which to raise iron ore, although undoubtedly some bog-iron ore does exist; perhaps the ore was imported, for Boate mentions iron works that were erected on the sea-board by persons who had "no mines upon or near their own land, but had the ore brought unto them by sea out of England, the which they found better cheap than if they had caused it to be fetched by land from some of the mines within the land." This custom was much resorted to on the coast of Munster, especially of Kerry, the ancestors of the present Marquis of Lansdowne having erected two or more on their extensive estates; and A. B. Wynne, F.G.S., records:—"At Blackstone, near the south end of Caragh Lough, are the ruins of a once extensive iron foundry, but where the ore came from does not appear.[3]

To the north-west of the co. Galway there seems also to have been iron smelting; for at Poulacoppel, near Kylemore (*Anglice*, the great wood), quantities of slag have been found. Here the ore may have been smelted in bloomeries, as no trace of an old iron furnace is now known to exist. Furthermore, no "old-men's-workings" for iron ore can be observed; however, in the extensive bogs and flats to the north-eastward, there is known to be deposits of the earthy limonite.

In the co. Mayo, on the north of Lough Mark, the Gildea's of Port Royal carried on a large iron trade; the remains of a furnace and of rolling-mills for refining the sow-iron into bar-iron still exist, and in the latter, until very lately, was the anvil; however, a few years ago, when the property was passing out of the hands of that family, it was taken away. In the flats and bogs adjoining the Aille river are the old pits and open cast, out of which the bog-iron-ore was raised; this ore, however, seems to have been mixed with red-mine, but where the latter was procured is uncertain.

Besides the mines of clay-iron-stone mentioned by Boate, there were also workings in the west of the county of Limerick adjacent to the River Shannon; and there is said to have been a furnace and mills in the vicinity of Loghill, while in the neighbourhood of Glin ruins of works exist. Smith says of the trade in the county Cork, "In all these works they use a sixth part of the English red mine to the native ore, in order to render it more ductile. Our ores are generally very rich, and make exceeding good iron. About the year 1632, the Earl of Cork had in his several forges, or bloomeries, in this county, 1,000 tons of bar-iron, besides 200 tons drawn out and faggotted into rods, at a fitting mill erected by his lordship, and about 20,000 tons of sow-iron. Bar-iron was then sold for £18 a ton." At the time Smith wrote (1750) the trade was on the decline, as the woods were nearly all cut down, and he suggested that charred peat should be used as a substitute for the wood charcoal.

Of Sir Charles Coot's[4] works, near Montrath (Lacka), Boate has left an elaborate description. He says they paid better than any other that was worked in his time, on account of the facilities there were for the shipment of the manufactured iron; however, Boate seems to have known very little about the works belonging to the Earl of Cork, as he barely mentions them. Coot paid five shillings and six pence per ton for the rock-mine, delivered at the furnace head, and seven shillings a ton for the white mine; the first was brought from the previously mentioned Desart mine, east of Maryborough; and the latter from Cullenagh hill, which lies to the S.E. of the same town. These ores were mixed in the proportion of one to two, "which yielded one-third part of iron; that is to say, of two tons of white-mine and one of rock-mine, being mingled together, they had one ton of good iron, such as is called merchant's-iron, being not of the first but second melting, and hammered out into bars, and consequently fit for all kinds of use." This manufactured ore was sent by boat down the river Nore to Ross and Waterford, for shipment to London; when the market price ranged from £16 to £17. 10s. a ton, the full cost to Sir Charles, including all charges, even custom, never exceeding £11. "A tun of merchant's-iron is usually had out of a tun and a half of sow-iron, but if that be of the best sort, and cast of the best oar, two hundred pounds less of it will yield the aforesaid quantity of a tun of merchant's-iron." Dr. Boate also gives a full description of the process of smelting

[1] *Statistical and Agricultural Survey of Galway.* By Mr. Hely Dutton.
[2] *Memoirs Geol. Survey of Ireland*, Ex. sheets, 124, 125.
[3] *Memoirs Geol. Survey of Ireland*, Ex. sheets, 182, 189, 190.
[4] This name is now spelt Coote.

and the refining of the sow-iron, which, in principle, is nearly similar to that in use at the present day. This author also records the existence of foundries "where the iron was cast into ordnance, pots, small round furnaces, and other things;" and he mentions that Mr. Christopher Wandsworth, Master of the Rolls in Ireland, "had one upon his lands by Idough, in the county of Carlow" (near the town of Castlecomer).

When the wood was cut down, the Irish iron trade succumbed. In England, "the energy and genius of one man," to quote Sir R. Kane, "rescued her from becoming a mere dependent for iron on the north of Europe, by inventing the process of reducing iron by means of coke. In Ireland, there was no man like Dudley. The iron manufacture in England assumed a new and enlarged existence. The iron manufacture of Ireland rapidly declined; and, finally, a century ago, in Kerry, the last charcoal furnace was extinguished, when they had burned out the last remaining wood."

DR. TYNDALL AND THE GERM THEORY.

WHEN Professor Tyndall disturbed the mind of the general public by his sensational endeavour to ventilate, in a popular fashion, a question that is still amongst the most uncertain of those by which men of science are perplexed, he must, one would conceive, have had some definite object in view. It is not too much to say that he has accomplished nothing but the generation of distrust in his own sagacity. We wish, however, to take advantage of the opportunity in order to say a few words on the present position of the debate, and to point out the inconclusive character of the evidence that has been adduced on either side. The case is one in which the imaginations of experimenters have outstripped their facts, and in which vast superstructures have been raised upon foundations wholly inadequate to sustain them.

We know, in a broad and general way, first, that there is some relation between the presence of atmospheric air and the occurrence of putrefaction; and, secondly, that the occurrence of putrefaction is attended by the development of various low forms of life. Mycologists have for many years been familiar with the abundant diffusion of the sporules or germs of the lowest fungi in the atmosphere; and from this knowledge it seemed but a step to the inference that the atmosphere might possibly not be itself the cause of putrefactive changes, but the mere carrier of the cause; and that the air itself, *quoad* oxygen and nitrogen, was powerless to initiate organic change. On the other hand, it was found that life came into existence under circumstances that rendered the presence of an antecedent germ improbable; and it was suggested, indeed, that it might begin anew, under favourable circumstances, and from certain aggregations of inorganic molecular matter. Now these two views, the doctrine of the derivation of the inferior forms of life from germs, and the doctrine of spontaneous generation, have very often been discussed as if they were antagonistic and incompatible. In reality they are neither. Assuming, as a matter of argument, that spontaneous generation is a thing of daily occurrence, it must still be admitted that the organisms thus generated may reproduce, and may become parents of their kind; and, in however many instances we may trace life to the presence of germs, or may see reason to believe that its absence is due to their destruction or exclusion, we are no nearer the proof that germs are essential antecedents to its development. It is fully open to one philosopher to demonstrate the existence of germs, and to trace their development into organisms of any degree of complexity. It is as fully open to another to show that organisms may come into being when all germs are excluded. But neither kind of evidence will destroy the other; and, indeed, there seems to be very high probability that both these views will at no distant time be established. If either were true exclusively, the evidence of its truth would not be difficult to obtain, and the conditions under which life might be looked for would soon be determined with absolute certainty. But, as a matter of fact, we now find the widest discrepancy between the results obtained by different experimenters. In some instances the most rude precautions suffice to prevent decomposition; in others, the most rigorous care to exclude germs is followed by the plentiful appearance of life. Every surgeon has met with cases in which an amputation wound has healed by the first intention, or in which a compound fracture, almost accidentally protected by a blood-crust, has never yielded a single drop of pus. On the other hand, we are told by Professor Lister and his followers that the most minute and anxious care is needed in order to secure such a result; and we are told by those who are not his followers that, in their hands, even this minute and anxious care has been unavailing. The differences familiar to us as surgeons in the wards are repeated among philosophers in the laboratory. M. Pasteur tells us, and others have confirmed his statement, that a plug of cotton-wool will preserve a flask of boiled milk for an indefinite time. Dr. Bastian informs us that abundant life will be developed in saline solutions from which all air has been removed, and in which all germs have been killed by heat. His experiments have yet to be repeated by others; and, until they have undergone this test, they are open to the obvious objection that they may have been in some way erroneously conducted. But this scarcely affects the point we wish to make—which is, that the best experiments terminating in either result do not exclude the possibility of the other; and that an experiment, however much it may confirm, is wholly unable to destroy. Regarded from one point of view, the question at issue is insoluble; because the proof of a negative is impossible. In the meanwhile, in all the practical affairs of life, we must be content to stop short of demonstration, and to act upon high probability. It is certain that the air around us, especially the air of populous places, contains much floating matter of a noxious character, many floating germs of common fungi, possibly many germs productive of special forms of disease. It is certain that the mechanical exclusion of such impurities, or their destruction by chemical agents, will often be highly advantageous. It is also certain that we cannot exclude in that way all the noxious agents that produce animalcular life, or zymotic disease; and we shall, in the present state of knowledge, only waste time and lose labour if we aim at the unattainable by an accumulation of minute precautions. The philosopher who tells the public that it is the duty of practical men to do this or that, at which practical men will only smile, is an ignis fatuus rather than a guide. Dr. Budd's suggestion to oil the skin of a scarlet fever case is an illustration of science brought to the aid of sagacity. Professor Tyndall's recommendation to a surgeon to open an abscess with a hot knife, is an illustration of an hypothesis carried to an absurdity. It reminds one of Captain Marryatt's hero, encouraging the organ of benevolence by a cupping-glass.—*Lancet.*

Electro-Magnetic Machines.—The invention of Mr. T. Slater, of Euston-road, which is spoken very highly of by those acquainted with it, consists, first, in the construction and arrangement of electro-magnetic machines, and in transmitting of the force obtained through these improved batteries and magnets, and rendering such force available for useful purposes, either through a reciprocating or rotative movement. The inventor constructs this magnet of the horse-shoe form, circular in section, but swelled out at the poles of the magnet at the end of each limb, so as to give a greater surface for the armature to work on, and otherwise for the increasing of the surface of the armature and power of the magnet. The magnet is either made of solid wrought-iron and circular in section, or built of sections of flat soft wrought-iron, plated, but also swelled out at the poles of the magnet. The inventor uses in his machine either one magnet or more than one, increasing the surface so as to obtain a greater attractive force for the armature to be attracted against by the "moment of force" alternately.

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From May 15th to 21st, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
2 Tigers (Felis tigris)	.....	Born in the Menagerie	Carnivora-dens
1 Himalayan Bear (Ursus Tibetanus) ♂	North India	Presented by Mrs. Nourse	Ditto
1 White-bellied Kangaroo (Macropus) (?) ♂	Australia	Purchased.....	Kangaroo-sheds
1 Hybrid Wolf (?) ♀	North America.....	Presented by C. Messiter, Esq.	Carnivora-dens North
1 Himalayan Bear (Ursus Tibetanus) ♂	North India	Presented by Commander Molyneux, R.N.	Carnivora-dens
1 Huia-bird (Heteralocha Gouldi)*	New Zealand	Purchased.....	Parrot-house
1 Hyacinthine Macaw (Ara hyacinthina)	Brazil	Ditto.....	Ditto
7 Ruddy Sheldrakes (Tadorna rutila)	.....	Hatched in the Gardens	Southern Pond
4 Turquoisine Parrakeets (Euphema pulchella) 3♀ & 1♂	New South Wales .	Purchased.....	Parrot-house
1 Black-faced Spider Monkey (Ateles ater) ♀	Isthmus of Panama	Presented by John Templeton, Esq.....	Monkey-house
2 Australian Sacred Ibises (Ibis strictipennis).....	Australia	Purchased.....	Lawn-pond
1 Ocelot (Felis pardalis) ♀	Mexico	Deposited by C. F. Oxley, Esq.....	Small Mammal House
2 Grey-headed Parrakeets (Agapornis cana).....	Madagascar	Deposited by Herr Hagenbeck	Parrot-house
2 Green-winged Doves (Chalcophaps indica).....	India.....	Presented by Col. G. W. Walker	Western Aviary
1 Bladder-nosed Seal (Cystophora cristata) ♂	Hudson's Bay	Presented by Capt. David Herd, C.M.Z.S.	Seal Pond
1 Tuatera Lizard (Sphenodon punctatum).....	New Zealand	Purchased.....	Reptile-house.
8 Egyptian Geese (Chenalopex Ægyptiaca)	.....	Hatched in the Gardens	Southern Ponds

♂ Male. ♀ Female. * Never previously exhibited.

IS ANY KNOWLEDGE USELESS?

In Two Parts.—Part I.

"THERE is no name of greater power at the present than that of Science; and it is as awkward to say anything against the pretensions of men of science as it once was to be a heretic of a different order. You cannot, it is true, be burnt alive, or put into an inquisition, but, which is almost as bad, you could be made to look extremely foolish. The men of Science regard you through their spectacles with an air calculated to strike terror into the boldest heart if you venture to question the advantage of their most trifling speculations. Anything which by hook or by crook can be brought under the mantle of an ology is a sacred object, not to be touched by the profane vulgar. A poor savage sees a civilized being, capable of producing thunder, and supplied with unlimited quantities of fire-water, devote himself for years to the pursuit of bugs—using that word in the American sense. This strange creature will live for months in a wilderness, and be amply rewarded by collecting a boat-load of creeping, crawling things, which are not even good to eat. The savage thinks the white man must be little better than an idiot; and the white man, when he comes home, writes his book, and holds the savage up to the derision of an enlightened public. 'Here,' he says in effect, 'is a poor creature so ignorant as to think me a fool for spending a month in discovering the *Hotonchrononthologus Jonesii*—an animal which differs from all other Hotonchrononthologi in having two more spots upon his nose, and an extra claw on his hind leg.' Is it so plain that the white man has altogether the best of the argument? Suppose that the beast in question had remained unknown, would the human race have been materially the worse? Or, to put it more moderately, could not the month be spent to more purpose in some other field of labour? Some distinguished martyr to science once planted a colony of some loathsome insect in his thumb, and heroically travelled to Europe with his burden, in the hope of discovering some new facts about the way in which the animal laid its eggs. Unluckily, if I remember right, the thumb mortified, and had to be amputated within sight of land; and we have ever since been called upon to admire the zeal and heroism of the sufferer. I am willing to do so, just as I admire St. Simeon Stylites for standing for twenty years on a column, and saying his prayers one thousand two hundred and forty-four times a day. Only I cannot help asking, in each case, whether so rare a quality of heroism could not have been turned to some better account? Zeal is not a commodity of which we have such an abundance that we can complacently set it running to waste. Science often means nothing more than accurate and systematic knowledge of facts; and the question always remains whether the facts are really worth knowing. If a man of genius spends years in investigating the habits of a microscopic animalcule, it does not follow that the game was worth the candle simply because we give to the knowledge gained the mystic name of science."

We quote the above because it gives a fair idea of the views of those practical men whose sphere of mental vision is circumscribed by the question *cui bono?*—in other words, men whose minds, if placed in the centre of a good old-fashioned silver dollar, would be entirely contained within the periphery.

The great value of most scientific facts lies not so much in the practical availability of the facts, as in the correlation with other facts, and the light which they throw upon scientific questions of confessedly high importance. The discovery of the supposititious *Hotonchrononthologus Jonesii* might not be a matter of much consequence in itself, but its relation to the Darwinian hypothesis, and its effect upon our views in regard to species, might possibly be so important as to immortalize the discoverer. So, too, it might not be a matter of much consequence in itself how a certain Acarus propagated its species; but a study of the process in this particular case *might* throw much light on generation in general, and this is certainly worth the expenditure of a good deal of zeal and labour. Full and definite knowledge of any subject is only to be attained through long study, and by examining the question from every point of view, and under every variety of circumstance and condition. The processes of generation carefully investigated in the lower animals have thrown great light on the corresponding processes involved in the reproduction of those of higher grade. Success in the breeding of domestic animals depends largely upon our knowledge of the causes that govern the variations of species and varieties. It is not at all impossible, under certain contingencies, that a mere dot on a fossil shell, buried millions of years ago, might decide important questions in this connection, and lay the world under everlasting obligations to the observer of these minute differences. The writer of the paragraph we have just quoted evidently does not appreciate the fact, that every thing in Nature is carried out strictly according to law, and that the most trifling fact is valuable as an index to these laws.

We copy the foregoing, with the able comments of the editor, from a recent number of the *Manufacturer and Builder*. We

rejoice that there are few persons, even amongst those so-called practical men who hate the very sight of a Latin word, who take such a narrow-minded view of true science; and that their numbers are fast diminishing. It is entirely unnecessary for us to undertake to show how most of those discoveries which have in a great measure brought about our present advanced civilization, have been made by the study of "small things," and by the "accurate and systematic accumulation of facts." But to show how, in our own Department of Science, the knowledge of a single fact which can only be obtained by a proper study of one of these "insignificant," creeping, crawling things, that are popularly called Bugs, may prove of great practical importance, let us instance one or two of the many cases that might be brought forward.—*American Entomologist and Botanist.*

HOW TO DISSECT A RAT.

BY E. F. ELWIN.

OF the numerous paths into which natural science draws its devotees, none presents so many advantages and charms as that of dissection. It is a skilful and beautiful art, which is easily learnt; and I intend here to lay down a few simple rules, gleaned from my own experience, for the benefit of some of the readers of *Science-Gossip*, as I strongly inculcate the principle of studying the structure with reference to the habits, and the habits with reference to the structure.

The implements are the first consideration. To begin with, it is highly necessary to be supplied with a sufficiency of good knives. Implements are expensive; and I would advise, as cheapest in the end, and far more convenient, the purchase of one of Weiss's Dissecting-cases. It contains six knives of graduated sizes, a pair of large and stout scissors for rough work, a pair of smaller ones for more delicate manœuvres, a pair of strong forceps, a blowpipe for wafting away delicate tissues, distending stomachs, &c., and three sharp hooks, each connected to a centre ring by a chain, which are exceedingly useful for hooking back limbs and flaps of skin which constantly are coming in the way. This set of instruments, which costs one guinea, is inclosed in a neat and portable case. The great difficulty is to keep the knives sufficiently sharp; but if you live near a town, it is easy to get them sharpened at a cutler's at a trifling cost.

The next requisite is a dissecting-board. It may either be the top of a deal table, or, still better, a separate oaken slab about 2 ft. long and 18 in. wide, which will suffice for all specimens of moderate size. You may then set to work in the following manner. Place a good-sized deal table, if possible used for no other purpose, in a window with a good light; spread a towel over it; on your right hand lay open your case of knives; put your oak board in the middle of the towel, the edges of which spreading round are exceedingly handy for wiping the implements upon; at the left hand corner of the table let there be a saucer for the portions of flesh you remove; in front of you station a tumbler of water, which is useful for a variety of purposes; supply, lastly, a handful of cotton wool to stanch the flow of blood if perchance you pierce one of the larger blood-vessels of your subject. Then, seating yourself on a high stool at the table, and taking some mammal, as for instance the rat, your equipment is complete, and you may commence work.

I prefer to begin with the digestive organs, since they are the parts most subject to corruption. With the scissors cut a long slit across the abdominal coat on a line with, and a little below, the ribs. From the centre of this, cut another slit downwards between the legs, either folding back or cutting off these flaps of skin, when a beautiful sight will be disclosed. Remove the intestines first, and cutting them through at the rectum and also at their connection with the stomach, seize them with the pincers with one hand, and with the knife in the other, by steady pulls and dexterous cuts the great mass will soon be freed. They may then be stretched out, measured, and their internal coats and the nature of their contents examined. Now disengage the stomach, care being taken not to puncture it in the operation. Its contents must be squeezed out through the pylorus and critically examined,—in many animals much interest depending upon this point. The stomach should then be washed, both inside and out, in the tumbler of water, until it is perfectly clean, and tying a piece of strong thread tightly round the lower orifice and inserting the end of your blowpipe into the upper one, tie a second piece of thread round it, inclosing the pipe with it. Holding the two ends tight, blow into the blowpipe until the stomach is well distended with air; then with your mouth drawing out the pipe, at the same moment pull the thread tight, and, securing it with a knot, it may be hung up to dry. It is, however, a performance which requires some knack to do successfully: either it is filled too full, and on a rise of temperature it bursts, or else enough air is not supplied, and it rapidly shrivels. Practice, however, will soon teach you the right medium.

On the right side opposite the stomach is the liver, with which the gall-bladder is connected. Beneath all, and on each side, are the kidneys, the cellular structure of which is interesting.

The dissector should next proceed to the heart and lungs. Having removed the diaphragm, that large muscular membrane which divides the thorax from the abdomen, it is far from easy to separate the circulatory and respiratory organs from the rest of the body, and it is necessary at the same time to disengage the trachea or windpipe, which unavoidably destroys to a certain extent some of the muscles of the neck. It should be separated from the head at the epiglottis—that lump which is popularly known in man by the name of Adam's apple. After detaching it in its course down the neck, which is easily done, it must be pushed through into the thorax, and seized with the forceps with the left hand, and with the assistance of the knife the attachments of the heart to the chest separated. In a few moments you will be able to draw it out uninjured, flanked by the lungs, and with the trachea rising from the centre. Dissecting this will be a charming occupation. You should notice whence the aorta, or great artery, starts, where the arteries branch forth to supply the head, where the vein enters carrying back the impure blood, and the arteries which carry the blood to the lungs to be purified, and the veins which return it to the heart. Next examine its structure: its four compartments; right and left auricle and right and left ventricle; its valves, muscular coats, and ligaments; the bifurcation of the trachea to each lung; the numerous branches of the bronchi; the structure of the trachea and of the epiglottis. If all this were done thoroughly, it would afford the dissector many hours of delightful study.

The viscera being disposed of, the head must now receive your attention. Here there are both muscles and nerves, veins and arteries to be dissected out, without destroying them all in the act. And this being impossible, it is necessary to select one or other of these points and sacrifice the rest. If the specimen is a kind of which you can get several with ease, you may devote one to each particular; but if it is a rare and unusual animal, the muscles bear the most importance. Investigating these is a laborious undertaking. You must carefully dissect away until you pretty well detach each muscle from its fellows along its entire length. You must then note its origin, or, in other words, from whence it takes its rise; its insertion, or where it goes to. Then its use must be determined. This may partly be done by observing what two portions of the frame it connects, and partly by pinching and irritating the muscle, when it will contract as it did when instigated by the brain. Those governing the complicated movements of the jaws and the neck will be traced with interest.

In the fore-leg or arm the same plan must be followed; often by pinching its muscles you may make the paw suddenly close up, clenched as if in defiance. The muscles of the hind-leg having been likewise identified and separated, you may proceed to the examination of the nerves of the opposite fore-leg, tracing them from their source, and disentangling them from their course among the muscles. The second hind-leg may be devoted to the observation of the veins and arteries; the former having valves opening upwards, and the blood in them of a darker colour than that which is in the latter. It must be kept in mind that the connection between the arteries and veins is by capillaries, which are hair-like vessels invisible to the naked eye. It would be a delightful exercise to devote an entire animal exclusively to the circulatory system, tracing from the heart the arteries spreading to the head, body, and legs, and the veins returning it from all these diverse parts again to the heart. It is best to select a moderate-sized specimen for this, since then, if a vessel is cut, the amount of escaped blood is not so great.

In small animals little can be done to the eye; but in large ones, such as the sheep or the ox, there is perhaps nothing that will give more delight. The purity of the vitreous and aqueous humours; their peculiar semi-firm and semi-fluid consistency; the beautiful blackening of the middle coat; the lens, the retina, and the exit of the optic nerve to the brain, are all objects of admiration. The eye must first be extracted from its socket, its security in which is astonishing. There is little fear, however, of piercing it, as its consistency is correspondingly great.

The dissection of the ear is attended with great difficulty, as all its important parts are lodged in the temporal bone, and it would be useless to attempt here to give any directions on the subject.

When you have traced the connection of the nose with the mouth, the cleft of the nostrils, their pituitory glands, and the fine network of nerves spreading over their delicate surfaces, you may proceed to the brain. This may be got at by carefully sawing asunder the skull at the jointure between the two parietal bones, care being taken not to cut and injure the delicate substance below. Then observe that it is divided into two separate portions—the upper brain, or cerebrum, and the lower brain, or cerebellum; that the great spinal nerve proceeds from the little brain, or cerebellum; that the cerebrum is formed of two hemispheres; that it is convoluted in structure, whilst the cerebellum is in layers, or laminated; that nerves branch off through little apertures in the skull to the eyes, nose, ears, mouth, and so on; and that the two hemispheres of the brain are subdivided into smaller lobes. The spinal nerves branching from the great cord, with the two roots to each—the one the root of the nerve of motion, and the other the root of the nerve of sensation—should be observed and followed.

The soft part of the animal frame is now finished, and the skeleton alone remains. But this in itself would take a separate article to demonstrate.

Cutting oneself whilst dissecting often turns out a very serious affair, and great care must be taken to avoid it. The most efficient remedy is to suck the wound, and then to hold the finger for same time in cold water, and not to take too rapid measures to arrest the bleeding.

Cautioning the anatomist to persevere, I wish him good speed in the cheery and sunny path of comparative anatomy.—*Hardwicke's Science Gossip.*

What the Chicago Telescope is doing.—One of the largest telescopes in the world, it is well known, is owned by the Chicago University. The destined work of this wonderful instrument is to make, in connection with nine chief observatories of Europe and America, an entirely new catalogue of 250,000 stars, determining the right ascension and declination of each particular star.

ON STAR-GROUPING, STAR-DRIFT, AND STAR-MIST.

BY RICHARD A. PROCTOR, B.A., F.R.A.S.

IN THREE PARTS.—PART II.

BEFORE proceeding to the subject of Star-drift, three broad facts may be stated. They are, I believe, now recognized for the first time, and seem decisive of the existence of special laws of distribution among the stars:

First, the rich southern region, though covering but a sixth part of the heavens, contains one-third of all the lucid stars, leaving only two-thirds for the remaining five-sixths of the heavens.

Secondly, if the two rich regions and the Milky Way be considered as one part of the heavens, the rest as another, then the former part is three times as richly strewn with lucid stars as the second.

Thirdly, the southern hemisphere contains one thousand more lucid stars than the northern, a fact which cannot but be regarded as most striking, when it is remembered that the total number of lucid stars in both hemispheres falls short of 6,000.

Two or three years ago, the idea suggested itself to me that if the proper motions of the stars were examined, they would be found to convey clear information respecting the existence of variety of structure, and special laws of distribution within the sidereal system.

In the first place, the mere amount of a star's apparent motion must be regarded as affording a means of estimating the star's distance. The nearer a moving object is, the faster it will seem to move, and *vice versâ*. Of course, in individual instances, little reliance can be placed on this indication; but by taking the average proper motions of a set of stars, no untrustworthy measure may be obtained of their average distance, as compared with the average distance of another set.

For example, we have in this process the means of settling the question, whether the apparent brightness of a star is indeed a test of relative nearness. According to accepted theories, the sixth-magnitude stars are ten or twelve times as far off as those of the first magnitude. Hence their motions should, on the average, be correspondingly small. Now, to make assurance doubly sure, I divided the stars into two sets, the first including the stars of the 1st, 2nd, and 3rd, the second including those of the 4th, 5th, and 6th magnitude. According to accepted views, the average proper motion for the first set should be about five times as great as that for the second. I was prepared to find it about three times as great; that is, not so much greater as the accepted theories require, but still considerably greater. To my surprise, I found that the average proper motion of the brighter orders of stars is barely equal to that of the three lower orders.

This proves beyond all possibility of question that by far the greater number of the fainter orders of stars (I refer here throughout to lucid stars) owe their faintness, not to vastness of distance, but to real relative minuteness.

To pass over a number of other modes of research, the actual mapping of the stellar motions, and the discovery of the peculiarity to which I have given the name of Star-drift, remains to be considered.

In catalogues it is not easy to recognize any instances of community of motion which may exist among the stars, owing to the method in which the stars are arranged. What is wanted in this case (as in many others which yet remain to be dealt with) is the adoption of a plan by which such relations may be rendered obvious to the eye. The plan I adopted was to attach to each star in my maps a small arrow, indicating the amount and direction of that star's apparent motion in 36,000 years (the time interval being purposely lengthened, as otherwise most of the arrows would have been too small to

be recognized). When this was done, several well-marked instances of community of motion could immediately be recognized.

It is necessary to premise, however, that before the experiment was tried, there were reasons for feeling very doubtful whether it would succeed. A system of stars might really be drifting athwart the heavens, and yet the drift might be rendered unrecognizable through the intermixture of more distant or nearer systems having motions of another sort, and seen accidentally in the same general direction.

This was found to be the case, indeed, in several instances. Thus the stars in the constellation Ursa Major, and neighbouring stars in Draco, exhibit two well-marked directions of drift. The stars β, γ, δ, ϵ, and ζ of the Great Bear, besides two companions of the last-named star, are travelling in one direction, with equal velocity, and clearly form one system. The remaining stars in the neighbourhood are travelling in a direction almost exactly the reverse. But even this relation, thus recognized in a region of diverse motions, is full of interest. Baron Mädler, the celebrated German astronomer, recognizing the community of motion between ζ Ursæ and its companions, calculated the cyclic revolution of the system to be certainly not less than 7,000 years. But when the complete system of stars showing this motion is considered, we get a cyclic period so enormous, that not only the life of man, but the life of the human race, the existence of our earth, nay, even the existence of the solar system, must be regarded as a mere day in comparison with that amazing cycle.

Then there are other instances of star-drift where, though two directions of motion are not intermixed, the drift character of the motion is not at once recognized, because of the various distances at which the associated stars lie from the eye.

A case of this kind is to be met with in the stars forming the constellation Taurus. It was here that Mädler recognized a community of motion among the stars, but he did not interpret this as I do. He had formed the idea that the whole of the sidereal system must be in motion around some central point; and, for reasons which need not here be touched on, he was led to believe that in whatever direction the centre of motion may lie, the stars seen in that general direction would exhibit a community of motion. Then, that he might not have to examine the proper motions all over the heavens, he inquired in what direction (in all probability) the centre of motion may be supposed to lie. Coming to the conclusion that it must be towards Taurus, he examined the proper motions in that constellation, and found a community of motion which led him to regard Alcyone, the chief star of the Pleiades, as the centre around which the sidereal system is moving. Had he examined farther he would have found more marked instances of community of motion in other parts of the heavens, a circumstance which would have at once compelled him to abandon his hypothesis of a central sun in the Pleiades, or at least to lay no stress on the evidence derivable from the community of motion in Taurus.

Perhaps the most remarkable instance of star-drift is that observed in the constellations Gemini and Cancer. Here the stars seem to set bodily towards the neighbouring part of the Milky Way. The general drift in that direction is too marked, and affects too many stars, to be regarded as by any possibility referable to accidental coincidence.

It is worthy of note that if the community of star-drift should be recognized (or I prefer to say, *when* it is recognized), astronomers will have the means of determining the relative distances of the stars of a drifting system. For differences in the apparent direction and amount of motion can be due but to differences of distance and position, and the determination of these differences becomes merely a question of perspective.[1]

Before long it is likely that the theory of star-drift will be subjected to a crucial test, since spectroscopic analysis affords the means of determining the stellar motions of recess or approach. The task is a very difficult one, but astronomers have full confidence that in the able hands of Mr. Huggins it will be successfully accomplished. I await the result with full confidence that it will confirm my views.

Turning to the subject of Star-mist, under which head I include all orders of nebulæ, I propose to deal but with a small proportion of the evidence I have collected to prove that none of the nebulæ are external galaxies. That evidence has indeed become exceedingly voluminous.

I shall dwell, therefore, on three points only.

First, as to the distribution of the nebulæ:—They are not spread with any approach to uniformity over the heavens, but are gathered into streams and clusters. The one great law which characterizes their distribution is an avoidance of the Milky Way and its neighbourhood. This peculiarity has strangely enough been regarded by astronomers as showing that there is no association between the nebulæ and the sidereal system. They have forgotten that marked contrast is as clear a sign of association as marked resemblance, and has always been so regarded by logicians.

Secondly, there are in the southern heavens two well-marked streams of nebulæ. Each of these streams is associated with an equally well-marked stream of stars. Each intermixed stream directs its course towards a Magellanic cloud, one towards the Nubecula Minor, the other towards the Nubecula Major. To these great clusters they flow, like rivers towards some mighty lake. And within these clusters, which are doubtless roughly spherical in form, there are found intermixed in wonderful profusion, stars, star-clusters, and all the orders of nebulæ. Can these coincidences be regarded as accidental? And if not accidental, is not the lesson they clearly teach us this, that nebulæ form but portions of the sidereal system, associating themselves with stars on terms of equality (if one may so speak), even if single stars be not more important objects in the scale of creation than these nebulous masses, which have been so long regarded as equalling, if not outvying, the sidereal system itself in extent?

The third point to which I wish to invite attention is the way in which in many nebulæ stars of considerable relative brightness, and belonging obviously to the sidereal system, are so associated with nebulous masses as to leave no doubt whatever that these masses really cling around them. The association is in many instances far too marked to be regarded as the effect of accident.

Amongst other instances[2] may be cited the nebula round the stars c^1 and c^2 in Orion. In this object two remarkable nebulous nodules centrally surround two double stars. Admitting the association here to be real (and no other explanation can reasonably be admitted), we are led to interesting conclusions respecting the whole of that wonderful nebulous region which surrounds the sword of Orion. We are led to believe that the other nebulæ in that region are really associated with the fixed stars there; that it is not a mere coincidence, for instance, that the middle star in the belt of Orion is involved in nebula, or that the lowest star of the sword is similarly circumstanced. It is a legitimate inference from the evidence, that all the nebulæ in this region belong to one great nebulous group, which extends its branches to these stars. As a mighty hand, this nebulous region seems to gather the stars here into close association, showing us, in a way there is no misinterpreting, that the stars form one system.

The nebula around the strange variable star, Eta Argûs, is another remarkable instance of this sort. More than two years ago I ventured to make two predictions about this object. The first was a tolerably safe one. I expressed my belief that the nebula would be found to be gaseous. After Mr. Huggins' discovery that the great Orion nebula is gaseous, it was not diffi-

[1] Here no account is taken of the motions of the stars within the system; such motions must be minute compared with the common motion of the system.

[2] Eight pictures of nebulæ were exhibited in illustration of this peculiarity.

cult to see that the Argo nebula must also be so. At any rate, this has been established by Captain Herschel's spectroscopic researches. The other prediction was more venturesome. Sir John Herschel, whose opinions on such points one would always prefer to share, had expressed his belief that the nebula lies far out in space beyond the stars seen in the same field of view. I ventured to express the opinion that those stars are involved in the nebula. Lately there came news from Australia that Mr. Le Sueur, with the great reflector erected at Melbourne, has found that the nebula has changed largely in shape since Sir John Herschel observed it. Mr. Le Sueur accordingly expressed his belief that the nebula lies *nearer* to us than the fixed stars seen in the same field of view. More lately, however, he has found that the star Eta Argûs is shining with the light of burning hydrogen, and he expresses his belief that the star has consumed the nebulous matter near it. Without agreeing with this view, I recognize in it a proof that Mr. Le Sueur now considers the nebula to be really associated with the stars around it. My belief is that, as the star recovers its brilliancy, observation will show that the nebula in its immediate neighbourhood becomes brighter (*not* fainter through being consumed as fuel). In fact, I am disposed to regard the variations of the nebula as systematic, and due to orbital motions among its various portions around neighbouring stars.—*Lecture before the Royal Institution.*

THE BAYAS (*NELICURVIUS*), OR WEAVER-BIRDS OF JAVA.

THE members of this remarkable group inhabit the whole of Southern Asia, including the neighbouring islands, and are characterized by the formation of the beak, which is somewhat prolonged, with the ridge vaulted, and joining on to the forehead almost in a straight line. The wings, of which the fourth quill is the longest, are of moderate length, the tail is short, the feathers being of equal size and sharply pointed, the tarsus strong, and of medium height; the colouration of the plumage is by no means bright. The Baya (*Nelicurvius Baya*), the most celebrated of the race, is of a dark brown upon the upper portion of its body, and all the feathers, particularly those of the wing and tail covers, are bordered with yellowish white; the breast is marked with light brown, the shafts of the feathers being of a deeper shade. The face and front of the throat are black, the top of the head bright yellow and the primary quills edged with a narrow yellow line. The female is without the black and yellow upon the head, the eyebrows are pale, the breast and chin of a whitish shade. The winter coat of the adult male is like that of the female; in the young male the breast is pale red. The beak is horn colour, the iris brown, the feet flesh-coloured, the eye dark blue. The length of this bird is 6 in., and its breadth 9½ in.; the wing measures 2¼ in., and the tail 2 in. This species is found extensively throughout India, Assam, Burmah, and the Malayan peninsula, frequenting woodlands in large numbers; it is much more rarely met with in the highlands of the Deccan. Corn, rice, and various kinds of grass-seeds constitute its principal food, but we have never been able to ascertain from our own observation that it will eat fruit. The Bayas breed during the rainy season, which occurs between April and September, according to the locality, and associate freely with other species. Their very curious nests, which in shape resemble a retort, are models of neat and compact architecture: these structures are generally hung from the branches of palms, or other trees, and in India we have never seen them elsewhere; in Burmah, on the contrary, it is not uncommon to find them suspended from the eaves of houses, or from the huts of the natives, some twenty or thirty in a row. On one occasion we observed not fewer than a hundred of these strange appendages hanging to the roof of one house, and the little occupants living on excellent terms with their human neighbours; it is, therefore, very remarkable that this same species in some places should occupy the most quiet and isolated situations, only visiting such districts as are but little frequented by man. The walls of the Baya's nest are composed of blades of grass, gathered while still green, or of strips of leaves, frequently those of the palm-tree, woven carefully together, the shape of the little edifice varying according to circumstances or the taste of its owner. As soon as the chamber allotted to the eggs is fully completed, the bird proceeds to build a partition wall, thus forming a second apartment, supposed by some naturalists to be the especial property of the male, whilst others imagine that it is only intended to separate the entrance passage from the cradle of the nestlings. The entrance is tubular, and is very strongly and firmly constructed, being destined to serve as the favourite sitting-room of the whole family, when the young birds have acquired sufficient strength. No sooner is the second chamber of which we have spoken completed, than the female, who has hitherto worked with her mate, retires into the part designed for her eggs, and occupies herself in weaving together the fine grass with which the interior is lined, the materials for the work being brought to her by the male bird, who alone continues the building of the passage and exterior portions of the nest. When this part of the work is concluded, the little artisan proceeds to carry in the lumps of clay, about the use of which so many opinions have been expressed. The natives assert that to these pieces of clay the male affixes fire-flies, to illumine the interior of the nest. Layard imagines them to be employed by the little builder as a whetstone whereon to whet its beak, whilst we ourselves are of opinion that they serve merely as a means of weighting the structure as it hangs suspended in the air, and have many times remarked that an unfinished nest contained more clay-balls than one that was completed. Very various accounts are given as to the number of eggs that form a brood; we have never found more than three, and feel sure that in cases where six or seven have been discovered two females must have occupied the nest. Young Bayas are frequently tamed, and form a most interesting and attractive addition to an aviary.—*Cassell's Book of Birds*, Part VI.

Effects of the Sun's Heat on a Sand-hill.—The following is an extract from a letter of G. Davidson, Esq., of the Coast Survey, dated U. S. Coast Survey Station, San Buenaventura, Cal., January 23, 1870, (communicated to *Silliman's Journal* by Mr. D. B. Smith, of Germantown, Pa.):—"I have had a very curious experience at this station. It is on the edge of a sandy, steep bluff, 70 ft. above the low flat margin that extends 300 yards to the sea-beach. At the station I had an 18-in. theodolite, with three reading microscopes, and was engaged in determining the azimuth of the principal lines of the triangulation from the station San Buenaventura. This involved observations from sunrise to 10 a.m., and from 3½ p.m. to 11 p.m. Imagine my surprise when I found that the heat of the sun pouring all the P.M. upon the south-west face of this bluff so expanded it that the level showed changes as great as 45"! Then, in the evening, contraction began, and continued until the level at sunrise exhibited changes of 45" the other way. Here was a change of 1′ 30" certainly due to changes of temperature; our lowest temperature was about 40°; our greatest about 79° in the shade, say, 100° in the sun. But this is not all; I was dismayed to find that, in cooling during the evening, the tongue of the bluff upon which the station is situated, twisted irregularly in azimuth as much as 18" in three hours. This, of course, vitiated all my results, and I continued a full series simply as an experiment, for I could not change my position for an eccentric one without many drawbacks. I did change my latitude instrument and transit from their positions near the station, and where the same phenomena were exhibited by them. At 102 yards from the edge of the bluff they are as steady as a rock, and I have nothing but the excessive undulations of the heated air to contend with."

THE JAVA WEAVER-BIRD (BAYA), AND NESTS.

REVIEWS OF BOOKS.

Cassell's Book of Birds. Translated and adapted from the Text of the eminent German naturalist, Dr. Brehm, by THOMAS RYMER JONES, F.R.S., Professor of Natural History in King's College, London. Part VI. London: Cassell.

THE sixth part of this exceedingly cheap and handsomely illustrated treatise is now before us, and it leads us to think that, should the succeeding issues equal those parts already published, the work will be one of the finest accounts of Birds generally which our language possesses. The coloured plate in this part represents Wagler's Cassicus, and is a most artistic representation. The text deals with the Passerine birds, and especially with the Weaver-birds of different climates, the Widow-birds, and the Buntings. Intercalated with the letter-press are many excellent wood-cuts; that of the Javanese Weaver-birds, which, through the courtesy of the publishers, we reproduce on page 487, being a very good example of the quality of the illustrations generally.

Other Worlds than Ours: the Plurality of Worlds studied under the Light of recent Scientific Researches. By RICHARD A. PROCTOR, B.A., F.R.A.S. London: Longmans. 1870.

LESS than ten years ago Mr. Proctor appeared before the public as little more than the compiler of a very interesting treatise entitled *Saturn and its System.* Since then the writer of these lines has watched his career with great interest; for in a long experience of the lives of those who turn to scientific literature he has found that the pecuniary temptations of the craft are so strong, that we may almost say of the scientific man who commences book-making in early life, "Once a compiler, always a compiler." But the author of the important work now before us was made of better stuff; and, while his labours as a writer have been numerous enough, his spirit of original inquiry has not abated a jot. Indeed, on the contrary, Mr. Proctor, while achieving a position as the most successful teacher of astronomy in England, has been all the while engaged actively in research, and has, during the period we mention, announced a series of discoveries which, of themselves alone, render his name famous wherever astronomy is studied.

The publishers of the work just issued could not, then, have exercised a wiser discrimination than in selecting Mr. Proctor to write a popular account of modern astronomical discovery and recent astronomical methods; for they found in him not only a polished and facile writer, but one who is not less skilled in the power of conveying knowledge than in the art of adding to our stock of scientific information. We congratulate Messrs. Longmans on their choice, and on the good fruit it has brought forth, and which they have laid so well before the educated public. It is not usual to find astronomical books which even the uninitiated may read with interest and profit; and which, nevertheless, deal with the most recent facts of science, and with some of the most complex problems which puzzle the philosopher. But such a work is that of Mr. Proctor. It is a book treating learnedly, and yet simply and intelligibly, of those great questions concerning the laws of the universe, of which the outside world has lately heard so much and understood so little, and it is written in such excellent English that its literary merits are nearly equal to its scientific ones.

We cannot, in the short space at our disposal, do more than indicate briefly some of the contents of the volume, though we could wish, were it not to the injury of the publishers, to reproduce whole sections of the work in these pages, for it must be distinctly stated that there is not a chapter which has not some special importance attaching to it. The book differs from most of its class in being full of original matter, which, though familiar to the astronomer, is quite new to the general reader. This chiefly consists in the exposition of some of the author's more remarkable hypotheses, and in the somewhat Socratic analysis (pushed sometimes, we think, a little too far) of the views of other workers at the heavens.

Notably would we refer to Mr. Proctor's chapter on the constitution of the sun. In this will be found a most attractive account of the researches which established the connection between magnetic disturbances and solar spots, and also the author's objection to the views which Mr. Lockyer and certain other observers have lately promulgated. Mr. Proctor's views on Star-drift and Nebulæ are now being laid before our readers in the publication of his recent lecture at the Royal Institution, so we need not dwell on them further. But this chapter on the sun is so especially significant in connection with Mr. Lockyer's ideas, that we must ask those who read the book to give it their careful attention. Mr. Proctor disputes Mr. Lockyer's explanation of the Corona and the Zodiacal lights, and accounts for these on the supposition that vast quantities of meteors are perpetually falling into the sun. Some of Mr. Proctor's objections to the theories of Mr. Lockyer appear most just, but we confess that in the present condition of facts we are unable to decide between the two astronomers. Some of Mr. Lockyer's arguments are most ingenious; and, though Mr. Proctor has fatally dissected others, we question whether some of his own views might not be similarly dealt with.

The only part of Mr. Proctor's admirable work to which we take exception is the last chapter, where he has introduced matters that are decidedly irrelevant, and which will produce a painful sensation in the minds of some. Such questions as those of miracles, and the efficacy of prayer, have nothing to do with physical astronomy; they are mere matters of faith; and we do not think that Mr. Proctor's well-intentioned defence of both prayer and miracles will satisfy even the mildest sceptic. As, for example, when the author, in commencing a syllogism which should demonstrate at least the rationality of a belief in miracles, Mr. Proctor writes, "Man differs from all other terrestrial creatures in being responsible to his Creator." To this the sceptic would reply—first prove the existence of the Creator, and then demonstrate that man does differ from other animals in this particular respect! And we must confess that, as a matter of pure reason, the sceptic would have the best of it. No; the author should have omitted these points from his otherwise most valuable essay. Still we recommend all our readers, whether astronomical or not, to get the volume and pass their own judgment upon it.

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It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

The Royal Society.

Sir,—I am gratified to find that the opinions expressed by me in a recent number of your journal have been echoed in other quarters.

According to a letter in the last number of *Nature*, it would appear that two candidates of established reputation have been passed over, whilst others, whose claims are slight, have been selected by the Council of the Royal Society, and recommended for election; and the still more important question has been raised, "What are the principles which govern the choice of Fellows in the Royal Society?" As a contribution towards the solution of this problem, I wish to put forward some facts relating to the election of the chemical side of the Society in late years.

One of the principles of action would seem to be not to elect an eminent chemist on his first application. Thus, Mr. Perkin was rejected on his first application. Dr. Roscoe had to apply four times.

The persistent rejection of Dr. Letheby is, again, a fact requiring elucidation, inasmuch as that gentleman has become a power in the State.

The instances of unworthy selection it is hardly possible to particularize; but, looking through the list of chemical Fellows, we are greatly puzzled in the attempt to assign the minimum of attainment which shall be compatible with admission to the Fellowship.

I am, &c., J. Alfred Wanklyn.

London, 23rd May, 1870.

Natural Selections and the Nest-building Power of Birds.

Sir,—In No. 81 Mr. Higgins quotes a passage from *Contributions to the Theory of Natural Selection*, by Mr. Wallace, in which the latter gentleman attributes the nest-building powers of birds to their faculties of observation, memory, and imitation; or, in his own words, "It would be very extraordinary if young birds could live for days and weeks in a nest, and know nothing of its materials and the manner of its construction."

Now, if such be the case, why do they not follow it out? I have known cases in which the birds never saw a nest, yet when the breeding season came round, they built their nest in the usual way and form.

One case I will relate:—The second day after a canary had hatched a sitting of five eggs, an accident occurred, by which the cage was knocked from the wall and broken, and, as a matter of course, its occupants were sent in all directions; two of the young birds were killed outright, the remaining three were carefully taken from the broken cage, and placed in another with the hen bird; the nest, having been destroyed by the fall, was replaced by a piece of flannel, into which the young birds were laid; the mother succeeded in rearing the whole three, two of which afterwards paired, and in time built a perfect nest from the materials given them, which, upon completion, in no way resembled the flannel in make, or the position in which it was placed.

Now, I ask, what was it that taught those birds to build their nest? Had it been their powers of observation, memory, or imitation, why did not the structure take the form of the heap of flannel, instead of that laid out by Nature's architect? Birds may, and doubtless have, the above-named faculties; but not, I think, sufficiently developed to enable them to build a nest from the mere remembrance of the one in which they were born, any more than a child would be able to make a cradle. I have watched a child concentrate all its attention upon the cradle in which it was lying. Was it the structure or the colour of the lining which fixed its little mind? What in after years will it remember of either? Nothing. I can see no reason why a bird babyhood should be of a more enlightened nature than the corresponding period of our own lives. I have known cases in which a thrush has been brought up in a blackbird's nest, and a house-sparrow in that of a linnet. But would the smoothly-plastered nest of the thrush be replaced by the nest of the blackbird, or the shapeless mass of the house-sparrow be replaced by the neat nest of the linnet?

I am, Sir, your obedient servant,

Colchester, May 27. W. M. C.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

May 19th.—The following papers were read, or "taken for read," "On the relative Duration of the Component Parts of the Radial Sphygmograph Trace in Health." By A. H. Garrod, of St. John's College, Cambridge. The graphic method of representing the various phenomena occurring in the body during life, which has been so much developed by MM. Marey and Chauveau, of Paris, has placed within our reach great facilities for obtaining an accurate knowledge of the relations, in point of time, of mutually dependent physiological events, and the sphygmograph has become, among others, an instrument familiar to most interested in science.

By means of this instrument, a detailed and truthful record can be easily obtained of the modifications in the diameter of any superficial artery, and, as usually constructed, it is intended to be applied to the radial at the wrist.

The traces to be referred to were taken with one of Marey's instrument, as made by Breguet. The recording paper ran its whole length 4⅞ in., in seven seconds, and thus, by counting the number of pulse-beats in each trace, and multiplying the number thus obtained by 8·57143, the rate of the pulse at the time the trace was taken was easily found.

The lever-pen was of thin steel, sharply pointed, and it recorded by scratching on highly-polished paper previously smoked.

It is now generally agreed that in each pulsation of the radial sphygmograph traces the main rise is the effect of the contracting ventricle sending blood into, and thus filling, the arterial system.

This rise is followed by a continuous fall when the pulse is quick, but when slow, its continuity is interrupted by a slight undulation, convex upwards.

The major fall is followed by a secondary rise, not so considerable as the main one, but more marked than any other, and this secondary rise is evidently due to the closure of the aortic valves preventing further flow of blood heartwards.

The two points, therefore, the commencement of the primary and of the secondary rise, may be considered to mark the beginning of the systole of the heart and the closure of the aortic valve respectively, as far as they influence the artery at the wrist; and the interval between these two events may be called the *first* part of the arterial sphygmograph trace, while the interval between the beginning of the secondary rise and that of the succeeding primary one constitutes the second part of the same trace.

In 1865, Professor Donders[1] published the results of experiments to determine the relative duration of the first and second part of the cardiac revolution with different rapidities of movements of the heart, taking as his data the commencement of the first and second sounds respectively; and he came to the conclusion that, though the second part varied with the rapidity, the first part was almost constant in all cases.

On commencing work with the sphygmograph, the author came to the same conclusion with regard to the trace at the wrist, but, on improving his methods of observation, he has arrived at a different result.

[1] *On the Rhythm of the Sounds of the Heart.* By F. C. Donders. Translated in the *Dublin Quarterly Journal of Medical Science*, Feb. 1868, from the *Nederlandisch archief voor Genees, en Natuurkunde*, Utrecht, 1865.

The best means of insuring an accurate measurement of any sphygmograph trace is to project all the points desired to be compared on to one straight line, and this is done by fixing the trace on to a piece of board, which has another pointed lever attached to it, with relations similar to those of the lever and recording apparatus in the original instrument. By this means lines can be scratched on the trace similar to those which would be produced by the instrument itself if the watchwork were not moving, and a result can be easily produced.

The reason why this means has to be employed is, because the lever in the sphygmograph moves in part of a circle, not directly up and down.

The ratio between the length of the first part of each pulse-beat in a trace and that of the whole beat was measured with a small pair of compasses, and from these the average was obtained, which thus eliminated, in a great degree, the variations produced by the respiratory movements, and also some of the clockwork imperfections.

For example, in the first of the figures exhibited by the author, the ratios in the several beats were :—1 : 1·8, 1·725, 1·725, 1·775, 1·725, 1·7, 1·725, 1·775, 1·8, 1·775, 1·675, 1·75, 1·75, 1·725, with an average of 1 : 1·7443.

Again, in the second figure, the ratios were :—1 : 3·8, 3·775, 3·8, 3·825, with an average of 1 : 3·8.

Calling the rate of the pulse x, and the number of times the *first* part is contained in the whole beat y, xy equals the number of times that the *first* part is contained in a minute, and $\frac{1}{xy}$ equals the part of a minute occupied by the *first* part of each pulse-beat.

From several observations, it was found that xy increases with x, not directly as it, but as its cube root; consequently, the following equation finds xy in terms of x

$$xy = k\sqrt[3]{x},$$

k being a constant, equal to 47 (about).

For instance, in fig. 1, $x = 137$, $y = 1·7443$;
and in fig. 2, $x = 44$, $y = 3·8$;
and $137 \times 1·7443 = 238\ 9691$;
$44 \times 3·8 = 167·2$;
and $238·9691 : 167·2 :: 1·43 : 1$,
and $\sqrt[3]{137} : \sqrt[3]{44} ::$
$= 5·155 : 3·54 :: 1·456 : 1$,

which shows that in these individual cases xy varies, within the limits of experimental error, as the cube root of x.

If this statement of the ratio of the *first* part of the trace to the whole beat is a correct one, a knowledge of the rapidity of the pulse alone is sufficient to enable the length of the *first* part to be found by multiplying the cube root of the rapidity by the constant quantity 47.

Thus, supposing the pulse beats 64 times in a minute, the cube root of 64 being 4, $4 \times 47 = 188$, and the length of the first part of the beat ought to be $\frac{1}{188}$ of a minute. In one case with $x = 64$, xy was found to be 185·75, and in another with $x = 63·5$, $xy = {}^{d}181·77$, both numbers which agree closely with the requirements of the equation.

With $x = 140$, and therefore $\sqrt[3]{x} = 5·2$,
$5·2 \times 47 = 244·4$;

and therefore the first part $= \frac{1}{244}$ – $\frac{1}{248}$ of a minute; in a pulse of that rapidity xy was found $= 242·9$.

To save the trouble of extracting the cube root for any rapidity, these facts have been thrown into a co-ordinate form in the accompanying table, and the observations on which the formula is based are represented by dots on their proper co-ordinates, the calculated curve, with $k = 47$, being represented by a continuous line.

Since the above equation was worked out, a great many other observations have been made, several of which are recorded on the Table, and in health no cases have been found which depart from the curve more than those indicated on it.

The observations made on the author are represented by simple black dots, those made on others are encircled by a ring; great size of a dot indicates that more than one independent observation has produced exactly similar results.

In none of the cases have measurements been made after violent exercise. Differences in the height and age of the subjects experimented on have not been found to produce any appreciable effect.

The trace from infants has not been examined.

From the equation $xy = \sqrt[3]{x} \cdot k$ the length of the *second* part of the pulse trace may be represented in terms of x, as $\frac{k - \sqrt[3]{x^2}}{x \cdot k}$; and as from the nature of y it cannot be less than unity (no pulse having been seen with two contractions or more between two successive closures of the aortic valve), the limit of cardiac rapidity may be deduced to be 322 in a minute ($k = 47$), but it is scarcely probable that pulses of such a rate could remain so sufficiently long to be counted.

In many cases of disease implicating the circulatory system, the equation given above indicates that the duration of the *first* part of the heart's action is not normal; thus, in a boy suffering from typhoid fever, on the second day after the pyrexia had ceased, and when the temperature was below the normal, xy was found $= 225·25$, where $x = 60$, which differs from the equation

$$\sqrt[3]{67} \times 47 = 190·82,$$

which shows that the length of the *first* part is considerably too short in the former. In the same case, three days later, the patient rapidly improving, with $x = 56·5$,

$$xy = {}^{d}188,$$

which is much nearer the calculated normal result, 180·5, than on the former occasion, the trace keeping pace with the other physical changes.

It is probable that many other imperfections in the circulatory system can be similarly indicated, and it has been shown above with what facility a diagnosis may be arrived at.

"A Ninth Memoir on Quantics." By Professor Cayley. A paper impossible to abstract in a brief space.

"On some Elementary Principles in Animal Mechanics.—No. IV. On the Difference between a Hand and a Foot, as shown by their Flexor Tendons." By the Rev. Samuel Haughton, M.D., Dubl., D.C.L., Oxon, Fellow of Trinity College, Dublin. The fore feet of vetebrate animals are often used merely as organs of locomotion, like the hind feet; and in the higher mammals they are more or less "cephalised," or appropriated as hands to the use of the brain.

The proper use of a hand when thus specialised in its action, is to grasp objects; while the proper use of a foot is to propel the animal forward by the intervention of the ground.

In the case of the hand, the flexor muscles of the fore arm act upon the finger tendons, in a direction from the muscles towards the tendons, which latter undergo friction at the wrist and other joints of the hand, the force being applied by the muscles to the tendon above the wrist, and the resistance being applied at the extremities of the tendons below the wrist by the object grasped by the hand.

From the principle of "Least Action in Nature" we are entitled to assume the strength of each portion of a tendon to be proportional to the force it is required to transmit; and since, in a proper hand, these forces are continually diminished by friction, as we proceed from the muscle to the fingers, we should expect the strength of the tendon above the wrist to be greater than the united strengths of all the finger-tendons.

Conversely, in a proper foot, the force is applied by the ground to the extremities of the tendons of the toes, and transmitted to the flexor muscles of the leg, by means of the tendons of the inner ankle, which undergo friction in passing round that and the other joints of the foot. In this case, therefore, we should expect the united strengths of the flexor tendons of the toes to exceed the strength of the flexor tendons above the heel.

In the case of the hand, friction acts against the muscles; in the case of the foot, friction aids the muscles.

I have measured the relative strengths of the deep flexor tendons of the hand above and below the wrist in several animals, and also the relative strengths of the long flexor tendons of the foot above and below the ankle in the following manner :—

I weighed certain lengths of the tendons above the wrist and ankle, and compared these weights with the weights of equal lengths of the flexor tendons of the fingers or toes, assuming that the weights of equal lengths are proportional to their cross sections, and these again proportional to the strengths of the tendons at the place of section. The difference between the weights above and below the joint represents the sum of all the frictions experienced by the tendons between the two points of section.

The following tables contain the results of my measurements :—

TABLE I. *Friction of Long Flexor Tendons of Toes.* (Cross section of toe tendons greater than cross section of muscle tendons.)

	Amount of friction per cent.		Amount of friction per cent.
1. Pyrenean Mastiff	65·4	17. Australian Dingo	33·8
2. African Lion	59·0	18. Japanese Bear	31.7
3. Common Fox	57·6	19. Virginian Bear	25·9
4. African Jabiru	56·8	20. Common Llama	25·9
5. American Rhea	52·4	21. Hedgehog	25·0
6. Indian Jackall	49·2	22. African Ostrich	24·6
7. American Jaguar	49·2	23. Common Otter	19·8
8. New Zealand Weka Rail	47·5	24. Man (mean of 5)	16·2
9. Silver Pheasant	47·4	25. Spider-Monkey	12·3
10. Bengal Tiger	46·0	26. Goat	9.5
11. Indian Leopard	45·5	27. One-horned Rhinoceros	9·0
12. Six-banded Armadillo	44·4	28. Negro-Monkey	8·0
13. Three-toed Sloth	42·5	29. Brahmin Cow	6·8
14. Black Swan	36·0	30. Nemistrine Macaque	2·0
15. Common Hare	36·0	31. Boomer Kangaroo	0·0
16. European Wolf	34·0		

The foregoing animals all realise the typical idea of a true foot, with a variable amount of friction at the ankle-joint; this friction disap-

pearing altogether in the Boomer Kangaroo, whose method of progression realises absolute mechanical perfection, as no force whatever is consumed by the friction of the flexor tendons at the heel.

The only animals whose feet deviated from the typical foot were three, viz., Alligator, Common Porcupine, and Phalanger. In these animals the foot has the mechanical action of a hand, or grasping organ; and the flexor tendons above the ankle exceeded those below the ankle by the following amounts:—

	Per cent.
1. Alligator	11·5
2. Common Porcupine	20·0
3. Phalanger	29·2

In the case of the flexor tendons of the hand, I obtained the following results:—

TABLE. II. *Friction of Deep Flexor Tendons of Hand.* (Cross section of muscle tendons greater than cross section of finger tendons.)

	Amount of friction per cent.		Amount of friction per cent.
1. Common Porcupine	71·0	8. Negro-Monkey	27·4
2. Sooty Mangaby	49·2	9. Spider-Monkey	26·5
3. Nemestrine Macaque	40·7	10. Bengal Tiger	22·7
4. Capuchin Monkey	35·3	11. Common Fox	20·7
5. Virginian Bear	35·0	12. Pyrenean Mastiff	7·0
6. European Wolf	31·4	13. Goat	0·0
7. Japanese Bear	30·6		

It will be observed that the fore-foot of the goat, regarded simply as an organ of locomotion, attains a perfection comparable with that of the hind foot of the Kangaroo, no force being lost by friction at the wrist joint.

The only animal in which I found a departure from the typical hand was the Llama, in which the flexor tendons of the fingers exceed the flexor tendon above the wrist by 14·4 per cent.

The bearing of the foregoing results on the habits of locomotion of the several animals will suggest themselves at once to naturalists who have carefully studied those habits. I shall merely add that the subject admits of being carried into the details of the separate or combined actions of the several fingers and toes, and that the habits of various kinds of monkeys in the use of certain combinations of fingers or toes may be explained satisfactorily by the minute study of the arrangement and several strengths of the various flexor tendons distributed to the fingers or toes.

"On the Cause and Theoretic Value of the Resistance of Flexure in Beams." By W. H. Barlow, F.R.S.—A paper on practical mechanics.

ETHNOLOGICAL SOCIETY.

MAY 24th.—*Anniversary Meeting.*—Prof. Huxley, president, in the chair. The report of the council and the treasurer's report were read and adopted. These reports showed that the position of the society was highly satisfactory. The president delivered an address, in which he gave a history of the efforts which had been made for amalgamating the Ethnological and Anthropological Societies, and hinted at the desirableness of union being effected between several societies having kindred objects. He also referred to the encouragement which the British Association had, since the Nottingham meeting, given to ethnological science by allowing the biological section to resolve itself into departments. The following is the result of the ballot for officers and council:—President, Professor Huxley, LL.D., F.R.S.; Vice-Presidents, Dr. A. Campbell, Sir John Lubbock, Bart., M.P., E. B. Tylor, Esq., Thomas Wright, Esq., M.A.; Honorary Treasurer, H. G. Bohn, Esq.; Honorary General Secretary, Colonel A. Lane Fox; Honorary Foreign Secretary, Hyde Clarke, Esq.; Council, W. Blackmore, Esq., Professor Busk, F.R.S., G. Campbell, Esq., Dr. Barnard Davis, W. Boyd Dawkins, Esq., M.A., F.R.S., J. Dickinson, Esq., Robert Dunn, Esq., J. W. Flower, Esq., David Forbes, Esq., F.R.S., A. W. Franks, Esq., M.A., Rev. Canon Greenwell, A. Hamilton, Esq., F. Hindmarsh, Esq., T. McK. Hughes, Esq., M.A., Dr. Richard King, Sir R. I. Murchison, Bt., K.C.B., J. F. McLennan, Esq., Rev. Dr. Nicholas, M.A., E. B. Pusey, Esq.

CHEMICAL SOCIETY.[1]

MAY 19TH.—Dr. Warren De La Rue, F.R.S., vice-president, in the chair.—Mr. S. H. Johnson was elected a fellow.

Mr. Griffin exhibited and explained a new gas-furnace, which is capable of melting about 3 lb of iron in little more than one hour.

Mr. Walenn described "A Method for Coating Cast-iron Objects, by Electrolysis, with Copper or Brass." The peculiarity of this method consists in the circumstance that no hydrogen is evolved during the process. The following is the prescription of an electrolytic bath for brass:—A mixture of equal parts of ammonic tartrate and potassic cyanide is saturated with cyanide of zinc and cyanide of copper; and to this solution oxide of zinc and cupric oxide are added. The bath has to be heated, during the process, to about 80°. Several articles (a calico printing valse, &c.), coated with brass in this manner, were submitted to the inspection of the assembly.

Mr. Tookey, Assayer in the Japanese Imperial Mint, communicated a paper "On the Manipulation of Assays of Gold and Silver Bullion." The number of separate processes, from the first weighing-in of a piece of gold bullion to the second weighing-out, before its value can be ascertained, are well known to all assayers. The author had, in connection with the late Mr. Hewny, commenced some operations, with the view to treat a batch of assays simultaneously, instead of handling them in rotation and individually, as by the ordinary method. The way pursued by him now is this.—A conical-shaped tube of platinum is closed at its narrower end with a perforated plate; the wider end is provided with a shoulder, so that it can be supported by a porcelain tile having circular holes. The tubes and the holes are numbered, so that each assay can be recognized after the operation. The whole arrangement is then immersed in a vessel containing hydric nitrate (of the proper strength), boiled for the requisite time, &c. In this manner a great number of bullions may be managed as one assay, and thus a considerable amount of time gained. A similar reduction in time can also be obtained in the assay of silver bullion by the "dry method." One of the operations in this method is the hammering and brushing of the silver buttons after they have been detached from the cupels. Mr. Tookey employs, instead of this, the following process:—He transfers the silver buttons into the depressed perforated cavities of a platinum plate, fastens each button by means of a handle of platinum wire, and immerses the plate in pure hydric chloride, which is heated until all bone-ash has been dissolved; the plate is then taken out, washed properly, and dried. The cavities of the plate are numbered to correspond with the cupels in the muffle.

Mr. Perkin read a note "On some Bromine Derivatives of Coumarin."

Bromine combines readily with coumarin, without the evolution of hydric bromide in appreciable quantities; but the product varies according to the manner in which the experiment is performed. The following definite results, however, were obtained:—On adding 1 part of coumarin diffused in carbon disulphide to 1 part of bromine, with several times its bulk of carbon disulphide, the coumarin combines with the bromine; and the compound is, after having allowed the carbon disulphide to evaporate spontaneously, obtained as a crystalline mass, which may be purified by re-crystallization from alcohol. Crystals, thus obtained, dried *in vacuo* and analyzed, led to the formula, $C_9H_6O_2Br_2$, which shows it to be dibromide of coumarin. It fuses at about 100°, with partial decomposition; and, when further heated, gives off bromine. It is easily soluble in alcohol; this solution is decomposed by heating or exposure to suplight.

When a mixture of 2 parts of bromine and 1 part of coumarin in carbon disulphide is heated, in a sealed tube, to about 140° for a few hours, a crystalline product is obtained on cooling, and large quantities of hydric bromide are given off on opening the tube. The crystalline substance is separated from the carbon disulphide, and dissolved in boiling alcohol, from which it crystallises out again on cooling. Analysis showed it to be $C_9H_4Br_2O_2$; that is, coumarin with two of its hydrogen replaced by bromine,—dibromocoumarin. It fuses at 174°, and distils unchanged; it dissolves in boiling alcohol, from which it crystallises in needles. The alcoholic mother-liquor from dibromocoumarin contains a second body, which can be obtained by evaporating off part of the spirit, and re-crystallizing the product for several times. The numbers obtained in the analysis agree with the formula $C_9H_5BrO_2$; it is therefore, bromocoumarin. It fuses at 110°, is more soluble in alcohol than the preceding body, and forms beautiful curved crystals. Both the bromo- and the dibromocoumarin, when boiled with aqueous potassic hydrate, yield potassium-salts of new acids—probably bromo- and dibromocoumaric acids.

Dr. Divers gave some remarks "On the Precipitation of Solutions of Ammonium-Carbonate, Sodium-Carbonate, and Ammonium-Carbamate by Calcium-Chloride."

The results of these experiments are chiefly of interest as supplying a characteristic reaction for the carbamate. If, to an aqueous solution of NH_3 and CaCl, a very little of a dilute solution of ammonic carbonate is added, a gelatinous precipitate forms, which soon dissolves, but, after a short time, again re-appears, and assumes a chalky condition. If a somewhat larger quantity of the dilute solution of ammonic carbonate is taken, the precipitate formed at first is permanent. In both cases, however, it takes days till the precipitation is so far complete that the supernatant liquid no longer gives any precipitate on being heated.

Sodic carbonate, under similar circumstances, behaves like ammonic carbonate. If, to a solution of CaCl, which contains no ammonia, some ammonic carbonate is added, the precipitation of the calcic car-

[1] From the *Chemical News*.

bonate is very soon completed; already after one hour, the supernatant fluid fails to give any precipitate on being boiled. It appears, therefore, that caustic ammonia acts here as retarding the precipitation of calcic carbonate.

If a little of a solution of ammonic carbamate (which was obtained by distillation) was added to excess of CaCl, a slight precipitation ensued at once. The supernatant fluid still gave, after two hours, a slight precipitate on being heated, but did no more after four hours. The supernatant liquid, in the case of ammonic carbonate, would have failed to produce any precipitate after the lapse of one hour.

If ammonic carbamate was added to CaCl in the presence of caustic ammonia, a slight precipitate appeared only after eight hours; and, in days after, the mother-liquor gave still a precipitate on heating. It thus becomes evident that ammonic carbamate soon passes, in the presence of CaCl and in the absence of NH_3, into ammonic carbonate; but the addition of NH_3 impedes such a change.

When ammonic or sodic carbonate is added in excess to CaCl, a chalky precipitate is formed; and, in less than hour, the filtered solution gives no precipitate when boiled. Addition of caustic ammonia accelerates the precipitation.

It appears, thus, that ammonia, in the presence of ammonic carbonate determines the precipitation of calcic carbonate, instead of impeding it, as it does in the presence of calcic chloride. Sodic carbonate behaves similarly to ammonic carbonate. The distinguishing reaction, therefore, between ammonic carbamate and ammonic carbonate is that, added in excess to ammonia and CaCl, the calcium is precipitated very slowly in the cold by the former, while it is precipitated immediately by the latter.

Dr. Thudichum made a short communication about having obtained hydric acetate from fresh urine—a fact contrary to the statements of Berzelius, Lehmann, and Liebig.

INSTITUTION OF CIVIL ENGINEERS.

May 24th.—Charles B. Vignoles, Esq., F.R.S., president, in the chair. The first paper, which was read in abstract, was "On the Relative Safety of different modes of Working Coal," by Mr. George Fowler.

It was maintained by the author, that whilst there was no possibility of freeing the workmen engaged in coal mining from accident, there was reason to hope for a considerable diminution in the proportion of those killed to the number employed. It was the purport of this communication to show that the mode of getting coal had considerable effect on the safety of the workmen.

The second paper, which also was necessarily read in abstract, was "On Coal Mining in Deep Workings," by Mr. Emerson Bainbridge, Stud. Inst. C.E. In this communication the principal conclusions arrived at were to the following effect;—Judging from the statistics of the past few years, the production of the British coal fields could not be considered to increase annually in a constantly increasing ratio, as had been surmised, but might be estimated at an average "output" of 105 millions of tons yearly. Estimating the coal remaining in the British Islands to a depth of 4,000 feet to be 37,300 millions of tons, this quantity of coal would supply the annual demand of 105 millions for 355 years; and, taking the limit to deep mining to be a depth from the surface of 7,000 feet, the further quantity of coal estimated to be workable to this depth was 57,222 millions of tons, which would extend the supply for a further period of 535 years. The chief localities in the British Islands where coal would probably be found at greater depths than had hitherto been reached were (1) the West Coast of Ayrshire, (2) the West of Lancashire, (3) the East of Yorkshire, Derbyshire, Nottinghamshire, and Staffordshire, and (4) below the seams worked at present in the South Wales basin.

NUMISMATIC SOCIETY.

May 19.—W. S. W. Vaux, Esq., President, in the chair.—Mr. T. Jones exhibited a first brass coin of Trajan, with a large ægis on the breast; and some third brass coins of Carausius and Allectus, struck in London and found in Cannon-street; also a small brass coin of Tiberius, with the heads of Nero and Drusus on the reverse, struck at Carthago Nova.—Mr. Henfrey communicated a description of an ancient British coin (type of Evans, pl. B, no. 8) found at Brighton.—Mr. Vaux read a paper, contributed by Mr. R. H. Lang, of Larnaca, Cyprus, "On Coins discovered by him during recent excavations in the Island of Cyprus," in which he pointed out the nature and value of a discovery whereby he has been able to obtain more than thirty varieties of the earliest silver coinage of the island, together with some specimens of that of the adjacent coast of Phœnicia. The coins were discovered whilst excavating an ancient temple near Daly (Idalium), in the form of two small treasures concealed under the pavements of two different chambers. The first was contained in two little earthenware jars closed with lead at the top; one of which was found in pieces, and the other was broken at the time by the pick-axe of the workman, the contents of both being in admirable preservation. The second was discovered a few days later, and from the way in which the coins were found to be adhering together, Mr. Lang conjectured that they had been once inclosed in a bag which had perished. Mr. Lang further concluded, from the character of the two treasures,—1. That of the two, the one originally in the presumed bag was the older. 2. That this treasure represented a Cypriote coinage of six or seven different independent kingdoms. 3. That when the later coins were deposited, the Cypriote coinage in the earlier treasure had ceased to be current, while the Phœnician coins of the *first* period were still in use. 4. That from the repetition of the second treasure of the Phœnician coins found in the first, there is probably no gap or period unrepresented between *them*.—Mr. B. Head read a paper communicated by Mr. S. F. Corkran, "On Personification on Roman Coins."

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

The following papers have been read at the meetings of this society, held during the past month, in the Midland Institute:—

On the 5th ult., Mr. James Bagnall read a paper by Dr. Braithwaite, of London, "On the Geographical Distribution of Mosses." It referred especially to the distribution of this class of the vegetable kingdom on the European continent, the whole area of which has been divided by Professor Schimper into three zones, as follows:—First, a northern zone, extending from the Arctic Ocean to the 60th degree of latitude, descending at its western extremity to the 57th degree, so as to take in the north of Scotland. Second, a middle zone, embracing all the country between the 60th and 46th degrees of latitude. And, third, a southern zone, extending south from the 46th degree, and including the Mediterranean and Black Seas. Of these three zones, the second is the richest in species, inasmuch as it includes the greatest extent of country, and the most varied surface. Besides this superficial distribution, another still more important one is that of altitude, or range above the sea-level, indicated by lines or arches extending from pole to pole, the crown, or highest part, being at the equator, and gradually descending northward, whilst at the arctic zone they become closely approximated. Professor Schimper has described five zones of altitude, all of which are characterized by certain predominant species. Commencing at the sea-level, there is first the Campatral region, or that of cereal plants and fruit-trees, which ascend the mountains to a varying height, dependent on the latitude. The second, or mountain region, ascends from the cultivated region to the upper limit of growth of the beech. The third, or sub-Alpine region, extends from the limit of the beech to the upper border of the spruce fir. The fourth, or Alpine region, commencing with the dwarf pine, ending where that tree ceases to grow. The fifth, or supra-Alpine region, reaching from the last-named to the line of perpetual snow. After some remarks on the habitats of mosses, the paper concluded with an allusion to their abundance and beauty, forming as Professor Schimper well observes, a verdant carpet, which animates with brightness the highest mountain, inaccessible to more perfect plants, enlivens woods impervious to the sun's rays, and protects the earth against the drying and congelation equally fatal to animal and vegetable life." The paper was illustrated by a beautiful and extensive set of specimens exhibited by Mr. Bagnall. A vote of thanks was unanimously accorded to Dr. Braithwaite. The following specimens were exhibited by Mr. Bagnall—*Fissidens incurvus*, from Solihull; by the Rev. A. Bloxam—*Fissidens exilis*, from Twycross; by Dr. Braithwaite—*Cinclidium stygium*, from Surrey; and *Dicranum virens*, from Bavaria; by Dr. Griffiths—a number of lichens from Yorkshire; by Mr. H. S. Scollick—Lepidoptera, captured on the 17th and 18th of March, 1870, at Moseley.

On the 12th ult. Mr. A. W. Wills read a paper entitled "Notes on Hydroid Zoophytes." After referring to the great interest of the subject, from its bearing upon the question of "alternation of generations," and to the position assigned to the Hydroida in the animal kingdom by recent systematists, the author described in some detail the structure and habits of the common hydra, and quoted the description given by Quatrefages of the sensation produced in "town and court" by Trembley's demonstration of the true animal nature of these creatures, and his establishment of the conclusion that "certain animals may, like plants, be reproduced both by slips (fissuration) and by buds (gemmation). The characters of hydra were entered into at some length, because this genus is in most respects a true type of the individual polypites, which by their aggregation into colonies, constitute the Thecaphora (including Campanularia, Sertularia, Obelia, &c.), as well as the Athecata (comprising Coryne, Tabularia, &c., &c.). The writer then proceeded to describe the arrangement of the polypites with respect to the central stem or axis in the principal groups, and the exquisitely elegant and often symmetrical organisms which result therefrom, and the mutual connection of all the individuals of the colony by means of the central pith or cœnosarc which runs along the

centre of the main stem and ramifies into every calycle. Remarking that in the animal, as in the vegetable kingdom, gemmation was, perhaps, inadequate to the indefinite perpetuation of the species, the intervention of sexual elements being alone competent to secure its permanent transmission, Mr. Wills passed on to a cursory review of this part of the subject, and pointed out that in all classes of the hydroid zoophytes the true reproduction of the species is thus provided for. The sexual elements (*i.e.* the "spermary" and "ovary") are sometimes present (as in plants) on the same individual; more often on different individuals of the species; and are sometimes carried in a bud or gonozooid cast off from the parent, with a free locomotion of its own, but which, in all cases, "sooner or later originates the generative elements." These "medusiform zooids" are so entirely unlike the parent zoophyte as to have been long regarded as medusæ, organisms widely different; but the researches of Van Beneden, Sars, Allman, Wright, and Thomas Hincks, have now clearly demonstrated their true nature, and proved that their exquisite structures are, in reality, neither more nor less than "swimming polypites," constituting a perfect means of diffusing as well as perpetuating the species. Within the ovary borne by the female "medusa-like" zooid is generated a minute conical embryo, known as a planula, which escapes into the surrounding water, moves for a time by means of countless cilia, and finally, as a climax to this strange series of fantastic metamorphoses, becomes fixed by its base, and reproduces the fixed colony, characteristic of its species, by simple gemmation or budding from various points of surface. The author bore an earnest testimony not only to the scientific acumen of Mr. Hincks, the author of *British Hydroid Zoophytes*, but also to his generous readiness to extend a helping hand to the earnest student of natural history, and concluded by appealing to the members of the society to direct their attention to this subject during their approaching summer excursions. The paper was illustrated by a number of mounted specimens, collected by the author, which were very successfully exhibited in the oxyhydrogen microscope, under the able management of Mr. J. Lancaster, jun. A vote of thanks was unanimously accorded to Mr. Wills for his very excellent paper.

On the 19th ult. Mr. J. Cotton read a short paper on "The Ruby." The chemical constitution and geographical distribution of this gem were referred to, and the history of some of the finest given, Mr. Cotton accompanying his remarks by the exhibition of a beautiful series from Ceylon, Brazil, Bohemia, the Capelar Mountain, the River Ganges, and Australia. On the conclusion of the paper the meeting resolved itself into a Conversazione and exhibition of specimens. Mr. Bagnall exhibited *Hypnum palustre*, from Wyre Forest, and a number of mosses from Sutton; Mr. G. Crofts, *Petasites vulgaris*, from Northfield; *Adoxa moschatellina*, *Paris quadrifolia*, and *Chrysosplenium oppositifolium*, from Hopwood; by Mr. Morley, *Polypollium vulgare* var. *semilacerum*, *Daphne mezereum*, and *Vinca minor*, from Bewdley; Mr. C. T. Parsons, fine specimens of Lepidodendron and Calamite, from a colliery at Wigan; Mr. J. L. Phelps, Bulla, Cerithium, and other species of Mollusca, and coral from the West-India Islands, and a curious malformed egg of the duck; Mr. C. Pumphrey, *Cochlearia danica* and *C. Angelica*, from Southport; also *Actinia dianthus*, Alcyonium, Eolides, and Hydroid zoophytes, from the same locality; Mr. Thomason, a fine specimen of *Pelias berus* (the common viper), captured in Sutton Park, March 23. Mr. Bagnall gave an interesting account of the excursion made by some of the members of the Society to Bewdley Forest on the 18th instant. Mr. F. Enoch reported having seen the following migratory birds:—The swallow, on the 10th inst., and the cuckoo, on the 18th inst., at Knowle.

On the 26th ult., Mr. A. R. Browne read a paper, entitled "Our rarer British Birds—the Grey Phalarope." This elegant little bird is only an occasional visitor to the British Isles; and it is chiefly to the Arctic navigators that we are indebted for our knowledge of its habits. The species frequent the shores of the sea, lakes, and rivers, and it is frequently met with at a great distance from land walking on the masses of floating seaweed or swimming in the open sea. Mr. Browne exhibited a specimen shot by himself at Aldershot, in September, 1866, and gave a graphic description of the difficulties he had to overcome before securing it. The plumage, at the different seasons of the year, and other peculiarities of the species, were described at length, and Mr. Browne concluded an admirable paper by expressing his intention of giving, on a future occasion, an account of other rare British birds which had come under his own personal observation. The following specimens were exhibited:—By Mr. Bagnall, *Viola Riviniana*, *V. Reichenbachiana*, and *Chrysosplenium alternifolium*, from the neighbourhood of Hales Owen; by Messrs. Blatch and Nelson, a number of Coleopter, Hemiptera, Lepidoptera, and Araneidæ; by Mr. Enoch, larvæ of *Triphæna fimbria* (broad bordered yellow under wing), and *Aplecta nebulosa* (gray arches), taken at Knowle, April 18th; by Mr. W. R. Hughes, *Eolis Landsburgii*, *E. Gracilis*, *Doris coccinea*, and *D. planata*. Mr. Hughes read a short paper descriptive of these beautiful marine nudibranchiata mollusca, which are for the most part inhabitants of the deep water, or are accessible only at the spring tides. In the aquarium the Eolis is an interesting object. It is exceedingly active and vigorous, twisting its body into a series of graceful curves, and erecting its branchiæ, which are disposed in several rows. At other times it floats on the surface of the water, with its foot uppermost; in which position it makes but little progress. When quiet, which is not often the case, the action of the heart may be clearly perceived. They are delicate animals, and require the water in which they are kept to be well oxygenated. The specimens were taken by Mr. Hughes at Sidmouth, Devonshire; and by Mr. C. Pumphrey at Southport.

ROYAL INSTITUTION OF CORNWALL.

The spring meeting of the Royal Institution of Cornwall was held on Tuesday, May 17th, in the Council Chamber, Truro. The chair was taken by the president, Mr. W. J. Henwood, F.R.S,, who delivered his address, in the opening of which he referred in suitable and feeling terms to the losses sustained by the deaths of Miss Emily Stackhouse, Major Bickford, Sir Wm. Williams, and Mr. Jonathan Couch. After referring to the ornithological works of Mr. E. H. Rodd, Mr. Maclean's *History of Trigg Minor*, Dr. Bannister's *Glossary*, Mr. G. C. Boase and Mr. Courtney's *Bibliotheca Cornubiensis*, Mr. Botterill's *Folk Lore*, and the *Chronological Memoranda* of Mr. Chorley, Mr. Henwood proceeded—

The unstable condition of the Cheesewring having become an object of remark in the newspapers, the Chief Inspector of Duchy Mines and his assistants received on the ground a sub-committee of your officers. It appears, from their report, that a quarry—long since worked on the north-east slope of the hill—has, of late, been materially enlarged; that enormous charges of gunpowder are occasionally fired within short distances of the Cheesewring; and that blocks of granite, placed to prop its overhanging slabs, have materially interfered with their picturesque appearance. A representation, embodying this report, was placed by your Council in the hands of Mr. Warington Wilkinson Smyth, F.R.S., with a request that he would submit it to the proper officers of the duchy; and we learn that they are about to take it into consideration. Ages ago many parts of the moor were furrowed by still earlier open works, and within the last half century many profitable mines, worked within short distances, brought a large and an industrious population into the neighbourhood. For the walls of cottages and the fences of paddocks, all stones—whatever their picturesque or traditional character—whether on duchy or on other private property—even portions of (the Hurlers) ancient rock circles, if suitable for the mason and the hedger, have been broken and carried off. As this indiscriminate havoc has been continued for time beyond memory, the moor has gradually lost that character of stern loneliness which harmonized so well with the wild crags of Kilmarth and the Cheesewring. But, in their turn, these, too, must give way, as other and yet more venerable objects have already given way to the convenience and the comfort, the wants and the welfare, of mankind.

Since our last meeting in this place, a law for the protection of sea birds has been enacted; and a society, already established at Bridlington for enforcing its provisions, has posted many of our ports and seaside villages with advertisements setting forth the penalties incurred by transgressors, and the rewards claimable by those who bring them to justice. Measures now before Parliament for compelling every bearer of a gun to take a license for so doing, may probably tend to diminish the number of thoughtless and cruel sportsmen.

The pilchards cured and exported during 1869 amounted to 15,139 hogsheads; the prices ranged from 64s. to 72s. per hogshead.

The mackerel fishery is just now in full activity; accounts to the present time, therefore, although sufficient for comparison with similar periods, give an insufficient idea of the year's returns.

During 1869 the quantity taken from Penzance and St. Ives by railway amounted to 71,959 pads, or 1,617 tons; to the 1st of May, 1870, the quantity taken from the same places in the same manner amounted to 40,103 pads, or 871 tons.

The quantities of pilchards, mackerel, and other fish taken for home consumption, I have been unable to ascertain.

The broccoli and potatoes forwarded from West Cornwall by railway has been:—

Years.	Broccoli.	Potatoes.
1869	2,358 tons.	1,918 tons.
1870	2,532 ,, ...	—

It has been calculated by experienced market gardeners that at least one thousand pounds worth of broccoli was destroyed by the frosts and snows of last winter.

Of the shipments from Hayle and Penzance I have obtained no accounts.

Plants hitherto unknown in West Cornwall have, within the past year, been discovered in the neighbourhood of Penzance; but the discoverer declines to announce his discovery.

The quantities of earthy and metallic minerals afforded by our quarries and mines are so accurately and so regularly ascertained by

Mr. Hunt, that it would be mere supererogation, on my part, to speak of them.

As we considered, twelve months ago, the proportion of copper precipitated from water flowing through the *Great Adit*, it can scarcely be out of place to mention the quantity of detrital matter deposited in the same neighbourhood, a subject brought before us by Dr. Barham in 1860. The valley of Caron, and its subordinate glens, drain an area of nearly two thousand acres; within which some thirty or forty mines have been wrought, to greater or less extent, at different times. In most of the water—whether mere drainage of the surface, or purposely pumped out of the mines—enormous quantities of various ores are *stamped* and (*dressed*) washed; the entire stream is, therefore, heavily charged with gravel, sand, and mud. And whilst copper mines were so largely worked in the district as they have been of late, the rate of deposit was probably even more rapid than it had previously been. At Higher Caron, nearly two miles above the present navigation, some rather remarkable slabs of granite formed a narrow road, from 1815 to 1820, or thereabout, some three or four feet above the ordinary level of the stream; in 1867, however, this ancient bridge had become buried beneath about two feet of detritus. Within about fifty years, therefore, a body of rubbish, brought down by the water, has raised the surface of the valley five or six feet; that is to say, at the rate of about one foot in ten years. As I speak in the presence of gentlemen much better acquainted than I can pretend to be regarding the effects of this remarkable stream, both on the navigation of Restronguet Greek, and on the depth of water in Falmouth Harbour generally, I will only allude to them. Anciently, however, the rigid exercise of stringent laws—as well of the Realm as of the Stannaries—restrained tin-streamers from works prejudicial to navigation; but these provisions, if not repealed, have long fallen into desuetude; nor do they seem, when in force, to have applied to copper mining. Yet, even now, the principal proprietor of mines in the adjoining country requires his tenants to intercept all sand, gravel, and mud escaping from their works; the influence of this measure on the condition of neighbouring rivers is shown by the increase of salmon in them.

In Sweden, at the beginning of this century, and in the Himalaya, some fifteen years ago, the miners obtained light—and sometimes were almost suffocated—when at their work by smoky flames from burning splinters of resinous pine. In Brazil, oil expressed from nuts of the *Palma Christi* is commonly used by the miners.

An experiment made at Balleswidden, near Penzance, during several months of 1856-7, attracted at the time much less attention than might have been expected, and is now almost forgotten. Coal-gas was made on the surface, and conveyed down one of the shafts to a depth of more than one hundred and twenty fathoms, through a 2 in. wrought iron pipe, from which branches, varying from three-quarters of an inch to one inch in diameter, were laid—in some cases for at least one hundred and seventy fathoms—along the several (levels) galleries; and similar tubes extended—occasionally as much as ten fathoms above the levels—to the various (backs or pitches) parts in progress. Flexible pipes of gutta-percha were, on occasions, carried to individual labourers, but where four men worked together, a single jet of gas gave light enough for them all. The captains of the mine reported that "In the shaft, levels and pitches it answered [so] exceedingly well as to leave no doubt of its serving all the purposes for which it was intended." It was computed that the works were lighted by gas one-third cheaper than by candles.

Dr. Jago read a list of donations to the museum.

A paper from Mr. Rodd was next read by Dr. Jago, "Twelve Months' Ornithological Notes and Occurrences in Cornwall." Dr. Jago also referred to natural history papers from Falmouth, which were, however, too minute in their descriptions to be read.

Mr. H. M. Whitley next read a paper contributed by Sir F. M. Williams, M.P., "Recent Observations on the Subterranean Temperature of Clifford Amalgamated Mines." This gave the result of various observations made during the past fifty years, and, finally, those made by Captain Gilbert previously to ceasing the deep workings some weeks since. Then, at 224 fathom level, being 279 fathoms from the surface, the highest temperature recorded was 123·5; and at 245 fathom level, or 300 fathoms from the surface, the highest was 125.

Mr. Smirke, on being called upon by the President, said that he was glad to have the opportunity of bringing before the notice of this society the communication of a gentleman (Mr. Maclean, F.S.A.), originally, he believed, of Cornish extraction, who had devoted himself to the history of the county with such ability and zeal, that if coadjutors could be obtained for him similarly endowed, his history would be the best that ever was written. He mentioned this as a condition of success, because he did not think one man's life would be long enough to accomplish such a work unaided. He (Mr. Smirke) should not read the communication for two reasons—first, because it was illegible; secondly, because it was unintelligible. The drawbacks indicated were not due to any deficiency of the writer, but in the original document there were abbreviations and contractions, which had been faithfully copied. The document was peculiarly interesting, as being the earliest coinage roll—dated 1305—containing a return of the duty on tin abolished thirty years ago. It was generally known that the Earls of Cornwall, succeeded by the Dukes of Cornwall, enjoyed a duty upon tin, which, after stamping, was duly levied; and the last gentleman who held the office of assay-master was their president, Mr. Henwood. The first documentary notice of Cornish mines is in Edward I.'s reign, and at that time there were four Stannary towns to which tin was brought, and duly stamped by Mr. Henwood's predecessors. Another point of interest would be the series of names presented in the document. Mr. Maclean called them the names of merchants, but he himself doubted the correctness of this description, from the aristocratic character of the names. Be this as it might, the list was valuable, and it was the document containing them that he now proposed to be printed. No such specimen had ever been printed before, and any assistance in his power to give to Mr. Maclean in the matter he should be glad to render.

The President thought that this communication of Mr. Maclean's, taken in connection with the laws and regulations which formerly governed the coinage of tin, threw considerable light on the comparative extent of tin works in different districts at different times. The earliest law he recollected mentioned Chagford, Ashburton, Tavistock, and, he thought, Plympton, as having been ancient coinage towns of Devon; whilst in Cornwall the coinage was appointed to be held at Liskeard two days, at Lostwithiel six days, at Truro twelve days, at Helston six days, and at Penzance two days—subsequently extended to six. In 1831, when he first took office, not a tradition remained in the Devonshire towns as to the period when tin had last been coined at any of them; and four years later, when a change was made in the coinage towns, it was found that the eastern part of Dartmoor had ceased to be productive, Liskeard and Lostwithiel had declined, Truro remained stationary, and Penzance had advanced.

A paper by Mr. W. Copeland Borlase was read by the Rev. J. R. Cornish, on "The Inscription of a Stone in the Churchyard of Stowford," and at its close Mr. Smirke congratulated the Society on the discovery of this inscription, which had been sent up to London last year and found indecipherable. The letters were a kind of Romanized Briton.

Mr. Pengelly, having been introduced by the president, apologised for the thinness of his paper, entitled "Notes on the Archæology and Geology of Devon and Cornwall," by saying that he had not visited them to read a paper, but he had brought a paper because he had come to visit them. In his paper he united the two counties; for geological formations had little respect for political geography; and whoever would understand the geology of either county must make frequent incursions into the other, and often go further afield than the limits of their boundaries. He wished now to suggest certain points of inquiry. A difficulty formerly existed in relation to the Devonian series of rocks, for while in the northern part of the area over which it extended there were found fish, in the south there were only sponges and molluscs. The late Mr. Jonathan Couch discovered in 1843 some fossils which he thought fish, but which Professor McCoy in 1857 pronounced to be sponges. The matter dropped till in 1857 he himself submitted to Mr. W. H. Bailey, a fossil found at Hannafore Point, near Looe; and it, with a number of the same kind collected, were pronounced, on the authority of Mr. Simmons and Professor Huxley, to be icthyolitic. The next point to which he specially wished to direct attention were the rock joints, of which they had two series, one running east and west, and the other north and south, and of which the one that crossed the other was naturally the more recent. Of the age of these joints few indications had been observed. At the eastern shore of Torbay, however, where both these systems were to be observed, it was evident that they were in existence before the close of the new red sandstone era, because their fissures were filled with dykes of that rock. The east and west dykes were faulted and traversed by veins of carbonate of lime, which came up on either side to the north and south dykes, but did not cross them. This showed that a considerable time must have elapsed after the formation of the first system of joints before the second. He would commend this subject to the geologists of the county. Next he would refer to the Lower Silurian fossils of the Dodman district. At Budleigh Salterton there was a remarkable collection of quartzite pebbles which contain fossils, of which the analogues were to be found in the rocks of Normandy. However, he objected to being beholden to Normandy if he could trace the pebbles to a source nearer home; and he should be delighted if some energetic young Cornishman would devote himself to the elucidation of these quartzite pebbles. Thirdly, whence were the flints on our western strand derived? There was no deposit of flints to the south of the Teign. The course of the shingle could be traced along the coast from the west to the east, and yet there was an abundance of flints, not only in the present beaches all round Cornwall, but in the raised beaches. It would be a comparatively easy, but valuable, task to ascertain the relative abundance of flints at various points. It would be of still more value if any one would dredge in the Channel and ascertain whether there were any submarine outliers of gravel from which the flints could be derived. Lastly, he would suggest an

inquiry into the megolithic monuments of Cornwall. The origin of "the Hurlers" at Liskeard and "the Merry Maidens" at Penzance was unknown, and it would be interesting to collect anything relating to them which tradition yet retained.

Mr. Whitley said that, with regard to the jointed structure of rocks in Cornwall, he had observed that the joints in Penwith took a south-easterly direction throughout, and that nearly all the valleys ran on the line of joints, and his inference was that the joints were the originators of the valleys. In Lundy Island all the main joints ran parallel to the line of junction between the granite and the slate. There is also a second system of joints running at right angles to the first. With regard to the quartzites, he had gathered some excellent specimens of organic remains at Gerrans, and found them precisely similar to those exhibited by Mr. Pengelly to-day, and probably this place and Gorran were the sources of the Budleigh quartzites. He regarded the flints as derived from the ancient drift beds which fringed our coast. The flint flakes scattered over Devon and Cornwall were clearly formed by nature, and not by the hand of man. He had brought home from the valley of the Somme some most delicate flakes struck off accidentally by a workman's hammer, and at Eastbourne had seen a great number of equally delicate flakes thrown off by the action of a crushing machine. Of course, in neither case was there any question of their being fashioned by man. Further than that, on the downs at Eastbourne he had found a large flint broken *in situ*, and on touching it two delicate cores fell out. He was strongly of opinion that the evidence did not support the theory of the human manufacture of these flakes.

Mr. Pengelly, in reply, said the question at issue was not one of flakes, but of implements. But whatever might be said about the flints, there could be no doubt that the instruments of bone from Kent's Cavern which he had the pleasure of exhibiting, and which were found associated with the remains of marine animals, were man's handiwork. Nor could there be any doubt about the human jaw, which he had himself found 20 in. below the stalagmite.

Mr. N. Whitley presented and explained two diagrams illustrating the local phenomena of the wind during the last few weeks.

Dr. Barham presented and explained an elaborate and interesting series of meteorological tables.

Mr. Michell Whitley presented and explained a very interesting set of diagrams showing the variations in the colour of Jupiter, and illustrating the mooted point of lunar activity, from his own observations.

Captain Williams read a valuable communication on boilor explosions, containing several practical suggestions.

Dr. Barham made a few observations respecting the set of thirty Roman coins presented by Mr. J. M. Williams out of the recent find in a tin urn near Carhayes. There were six specimens of each of five emperors or *quasi* emperors, extending from A.D. 233 to A.D. 276. He also read brief communications relative to old fortifications in East Cornwall from Mr. S. R. Pattison, Mr. F. Rodd, and Mr. E. Coode.

The customary votes of thanks closed the proceedings, Mr. Whitley stating that the excursion this year would be to Bodmin and the north coast, including Tintagel, and would last two days.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

MAY 12TH.—The president, Mr. T. H. Hennah, F.R.M.S., in the chair.

Mr. Wonfor, hon. secretary, reported on the success of the Field Excursion, on the previous Saturday, to Balcombe, and announced that Mr. H. Willett had invited the society to pay him a visit at Findon in June.

The meeting being for the exhibition of specimens, Dr. Badcock exhibited a large piece of fossil wood recently obtained by his brother at Portland Island.

Mr. Penley laid upon the table a copy of the first part of the *Flora of Tunbridge Wells*, by Dr. R. Deakin, in course of publication, and specimens of oak picked up at Tunbridge Wells, and which was stained green by a fungus, *Helotium æruginosum*, growing in it. This supplies the green seen in Tunbridge Wells ware.

Dr. Hallifax commented on the growth of this fungus, and stated that he had raised it from spores obtained from specimens of the green-coloured oak. There was no doubt of the true nature of the fungus, for in thin slices of the infected wood the *mycelious* threads, and at times the spores, could be made out.

Mr. Wonfor remarked on the fact that this fungus was only found in woods in England and France where the Hastings sands cropped out. This would lead to the inference that there was something peculiar in the chemical conditions of the soil, &c., which favoured its development.

Mr. Hennah exhibited a couple of live Sea-mice, *Aphrodita hispida*, dredged up off Brighton a few days before, and remarked on the hairs as microscopical objects.

Mr. Dennant exhibited a bottle of ooze, obtained in the *Porcupine* expedition in lat. 47° 35′ N., long. 12° 15′ W., at a depth of 2,435 fathoms, the surface temperature being 65° 5′ Fahr., bottom temperature 36° 5′ Fahr.; pressure equal to 457 atmospheres, or nearly three tons to the square inch. The ooze, which consisted of calcareous mud, containing Globeriginæ and Foraminiferæ, would be shared among the members at the microscopical meeting.

Dr. Hallifax exhibited a number of very beautiful micro-photographs taken by himself, some of the most striking being—stomach of owl (40 diam.), showing the glandular structure; teeth of medicinal leech, 480 diameters, in which the true nature of the teeth was well shown; sections of proboscis of blow-fly, one transverse, the other vertical, intended to exhibit the rasping teeth on the centre of the disk—in the photographs they were almost isolated, and stood out very conspicuously; poison bag of spider, with poisonous fluid issuing therefrom—in mounting, a slight pressure on the covering glass had caused the poisonous fluid to exude; a curious spine of echinus, tracheæ of silk-worm, and tongue of bee.

Mr. Wonfor exhibited cluster-cups on the dog-violet, *Viola canina*, and on the common nettle; cast of owl, consisting of the fur and bones of mice; and cocoons and eggs of emperor moth, *Saturnia carpini*, and forty-three males of the same moth, attracted in two days, at Polegate and Tilgate Forest, by one female; and read a paper on the power possessed by some females of attracting the males of the same species in great numbers and from long distances, in which he detailed the experiments tried by himself and others with various insects, to find out, if possible, by what sense they are drawn. Sight was out of the question, for they had come up when the female was in a box in the coat-pocket, or shut up in a bag. It would seem that scent was more likely, for they always came up against the wind, while it was noticed that if they got far to windward, they did not return, but flew away.

Mr. Hennah announced that Mr. Peake had found a *Pygidium* on the lace-wing fly (*Chrysopa perla*)—this, he believed, was an original discovery. It would be shown at the microscopical meeting.

Mr. Wonfor announced that the first meeting of the Microscopical Section would take place on Thursday, May 26, when the president would deliver a short inaugural address. Members were requested to bring microscopes and slides. It was also hoped they would be ready with contributions of slides for the Society's cabinet.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

PARIS, MAY 23RD.—The corespondence of the day was opened by M. Elie de Beaumont.

M. Chevreul proposed the publication of a memoir on the means of distinguishing the threads of flax, hemp, cotton, *phormium tenax*, &c. This proposition received the approval of the Academy.

M. Henri Sainte-Claire Deville read a paper on the action of water on iron, and of hydrogen on oxyde of iron. He stated that he treats perfectly pure iron by the vapour of water at a known temperature and pressure, the iron being kept at a constant temperature during the period of the same experiment. He states the following as among the results arrived at:—(1) When we submit any weight whatever of iron to the action of water-vapour, the iron is oxidized until the tension of the hydrogen reaches an invariable value, while the temperature does not vary. This tension may be a fraction less than the atmospheric pressure. This tension being absolutely independent of the quantity of iron acted upon, it may be said that the hypothesis of Berthollet—*the action of mass*—does not explain this phenomenon. (2) When the maximum pressure of the hydrogen, corresponding to a given and invariable temperature, has been attained, if a quantity of the gas be removed, the pressure, sensibly diminished, is soon re-established by the decomposition of a new portion of the water, which is evaporated. (3) When the vapour of water is in contact with iron at an invariable temperature, we may bring the space containing the moist hydrogen to any temperature desired (provided there is no condensation of the water) without altering the tension in this space. If, for example, the apparatus be heated, the tension of the gas increasing, the hydrogen condenses on the oxide of iron, and its tension resumes the maximum value, which corresponds to the temperature to which the iron is raised.

M. Edouard Lagout brought forward another paper "On the Equatorial Sundial."

SOCIETÉ PHILOMATHIQUE OF PARIS.

PARIS, APRIL 8TH.—At this meeting a lengthy and interesting paper was read by M. Léon Vaillant, on the characters which serve to distinguish *Vermetus* from the shell cases of certain annelids. In commenting on the labours of other naturalists, he pointed out what great services

Dr. Carpenter had rendered to science by his researches on the structure of shells.

ROYAL INSTITUTE OF LOMBARDY.

MILAN, MAY 5TH, 1870.—The meeting was opened by Professor Verga, who read a paper, entitled—"Pneumatic Medicine;" and Signor Eugenio Bertin, Signori Mantegazza, Castiglioni, and Frisiani made some remarks with reference to this paper, to which Signor Verga replied.

Professor Mantegazza then read a paper on a singular case of Microcephaly in a woman. Dr. Castiglioni also presented a photograph of a like case.

Dr. Valsnani adduced, lastly, a case of Microcephaly observed by him recently, in the Children's Clinic at Milan, in a deaf and dumb idiot of about three years of age, affected with a catarrhal pulmonary affection, of which it died. He had made an accurate inspection of the state of the vascular system of the cerebellum. He found that the internal carotid was reduced to nearly a third of the normal size. This little Microcephale had the face so largely developed as to amply compensate for the minuteness of the cranium.

Professor Sangalli read his memoir "On Freedom of Instruction."

Professor Zoncada brought forward a continuation of his work, entitled "Formation of the Latin, and the derivation of the Italian from it."

Professor Ascoli made some observations with reference to the allusions made, in Professor Zoncada's paper, to the Italian language.

The meeting then passed on to other affairs, and elected a commission to enquire into the relative merits of the three competitors for the triennial medals; also another commission on the instruments of precision. The members of this commission were—Signori Frisiani, Cantoni, Codazza, Haich, Schiaparelli, Vaga, and Signor Colombo.

The meeting was then brought to a close.

NOTES AND MEMORANDA.

An Ingenious Letter-Box.—We learn from the *American Engineering and Mining Journal* that "a citizen of Buffalo has patented a letter-box for street use, which possesses many advantages over those now in use. Its arrangement is such as to admit letters or packages of moderate size, and at the same time shut off all possibility of access to the box, except by opening the lower receptacle, and violating the Government lock. The opening into the box forms a table, upon which the letter-carrier may take out the mail-matter deposited. But this is but a minor arrangement as compared with the automatic process by which, if mail-matter is deposited by any person, he can see that it is dropped into the final repository, and be sure that it cannot be extracted by any other than the letter gatherer. The process of this is very simple. The cover of the box acts by means of a few simple rods in the interior in such a manner that, when the cover, or lid, is moved to admit mail-matter, the aperture of the lower box is closed, and the mail-matter is precipitated to the receptacle mentioned. The interior metal-box is so arranged that when the top is opened, at no angle can any substance reach the depository. The opening of the lid closes all access to the lower box, and the closing of the lid drops the mail-matter into it."

Marine Couch for Preventing Sea-sickness.—We would call the attention of steamship companies to an illustrated description of Newell's marine couch, published in the last number of the *Scientific American*. Mr. Newell has patented his invention in Europe as well as in the United States, and is desirous of interesting capitalists in its introduction.

SCIENTIFIC DIARY.

WEDNESDAY, June 1st.

Obstetrical Society, 8 p.m.
Ethnological Society, 8.30 p.m. "Report on the Prehistoric Antiquities of Dartmoor," by G. Spence Bate, Esq., F.R.S.

THURSDAY, 2nd.

Royal Society, 8.30 p.m.
Society of Antiquaries, 8.30 p.m.
Linnæan Society, 8 p.m. "On New Forms of Trichopterous Insects," by Mr. R. M'Lachlan.
Chemical Society, 8 p.m. "On Platino-Ammonium Bases," by Dr. Odling.
Royal Society Club, 6 p.m.
London Institution, 7.30 p.m.
Royal Institution, 3 p.m. "Electricity," by Prof. Tyndall.
Perthshire Society of Natural Science, 8.30 p.m. 1. "The Waterfowls of the Tay and its Tributaries—(1) The Waders." 2. "Notes on the Eggs of *Lepidoptera*."

FRIDAY, 3rd.

Geologists' Association, 8 p.m.
Philological Society, 8.15 p.m.
Royal Institution, 8 p.m. "Migration of Fables," by Prof. Max Müller.
Archæological Institution, 8 p.m.
Aeronautical Society of Great Britain, 8 p.m. Annual Meeting (Society of Arts).

SATURDAY, 4th.

Royal Institution, 3 p.m. "On Comets," by Prof. Grant.

SUNDAY, 5th.

Sunday Lecture Society, 3 p.m. "On The Life and Times of Turgot," by W. B. Hodgson, Esq., LL.D.

MONDAY, 6th.

Entomological Society, 7 p.m.
London Institution, 4 p.m.
Royal Institution, 2 p.m. General Monthly Meeting.

TUESDAY, 7th.

Royal Institution, 3 p.m. "On Present English History," by Prof. Seeley.
Ethnological Society, 8 p.m. "On the Geographical Distribution of the Chief Modifications of Mankind," by Prof. Huxley, LL.D., F.R.S., President.
Syro-Egyptian, 7.30 p.m.
Birmingham Natural History and Microscopical Society, 7.30 p.m.

WEDNESDAY, 8th.

Geological Society, 8 p.m.
Royal Microscopical Society, 8 p.m. "Experiments on Fermentation and Parasitic Fungi," by John Bell, Esq., of the Laboratory, Somerset House; and "On a New Form of Binocular Microscope," by John W. Stephenson, F.R.A.S.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.
Royal Society of Literature, 4 15 p.m.

SCIENCE AMONG THE MORMONS.—"A. G. M."—There is no such institution as that named in your letter. Some one has been hoaxing you.

BRIGHTON NATURAL HISTORY.—"W. T."—We quite agree with you. Anything more ridiculous than the dialogue, in the new *Brighton Guide*, between Mr. Arnold and his two pupils, we have never read. It, too, as you say, occupies nearly a third of the volume.

THE BARNACLE GOOSE.—"T. V. A."—Patterson, in his *Zoology for Schools*. The metamorphosis is, unquestionably, retrograde.

TENSION AND TEMPERATURE.—"Tyro."—Consult any book on Physics. Ganot's will do very well. The relationship is exactly as you have expressed it.

VEGETABLE IVORY.—"N. A."—Never in such large pieces. The structure shows it to be true dentine.

THROWING DOWN POTASH.—"M.A." The bichloride of platinum. It forms thus a double chloride.

GRAPHIC FORMULÆ.—"W." We thank you for your expression of opinion. The whole idea is absurd from first to last.

ELECTRO-MOTOR FOR SEWING-MACHINES. — "Only a Woman" will find that it has been applied in America. The employment is, however, as yet, not on a large scale. We hope to be able, ere long, to give an account of a better method. We will bear your request in mind.

TABLE TURNING.—"Truth." We are afraid that you must have been, as the saying is, "at the bottom of a well." Don't believe the nonsense you have been told.

A GOOD SEA-SIDE PLACE FOR MARINE ZOOLOGISTS.—"T.G.P." We can hardly give you the advice you require under the special conditions you name. Try Aberystwith, in Wales.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.—T. W. W."—Thanks for the report, which shall appear next week. We did not know the individual mentioned was a musician as well as a *servant*. He plays the trumpet well.

ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.—"E. J. N.."—The request of the Academy shall be laid before our publishers, who, no doubt, will be glad to avail themselves of the proposal kindly made.

"SCIENTIFIC NEWS."—W. M. C.—Thanks.

WEDNESDAY, JUNE 8, 1870.

THE ASTRONOMER ROYAL'S REPORT.

THE Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, was, as we had previously announced, delivered on Saturday last, the 4th inst. It was, it must be confessed, a most satisfactory account, not only of the year's progress, so far as the instruments of the Observatory are concerned, but also of the general condition of the Observatory itself. It may not be uninteresting to our readers if we lay before them a few of the more leading details which Mr. Airy has supplied us with. So little is known by the public of the general nature of scientific research, and especially of those branches of physical investigation to which attention is paid at Greenwich, that the account of the twelvemonth's labours at the Royal Observatory, even though it be indicated only in the alterations which have taken place, cannot but be of importance.

Firstly, in regard to the modifications of the building generally, we may mention that very little change of any serious import has taken place. Perhaps the alteration in regard to the earth-current self-registering apparatus, which has hitherto been placed in the western arm of the basement, nearly in contact with its south wall, and under the staircase, is most noteworthy. The Astronomer Royal says that he is commencing to transfer this apparatus to the eastern arm of the basement, to be nearly in contact with the south wall there. The apparatus will thus be more accessible; and it seems probable that the removal of the lights from the west to the east end will tend to destroy the slight elevation of temperature which has usually been remarked at the west end. The immediate motive for this shift was to give facility for the introduction of mechanism for imprinting simultaneous photographic hour-lines on the registering barrels. We observe, too, according to the report, that, in the south ground, the great shed and the depôt for printed publications were erected shortly after the last inspection by the visitors; and an anxiety was expressed by some persons in regard to the risk of damp to the books inclosed in a wooden shed without artificial warmth; but Mr. Carpenter, who has been instructed carefully to examine the books, states that, during this winter, there has been no sign of damp.

Not the least valuable part of the Observatory is that which is devoted to the keeping of manuscript notes, records, &c., of observations; and the great use made of these by astronomers is, in itself, a proof of their importance. From an early period to his connection with the Royal Observatory, Mr. Airy perceived that it would be desirable to establish some plan of arranging papers, by which they should be placed in order, and made mechanically secure, before the operations of the professional binder commenced; that, in fact, except for the papers last come to hand, there should scarcely be such a thing as a fugitive paper in the Observatory. The system then arranged has been steadily carried out; at present it is accurately worked by Mr. Carpenter, and all bound volumes have lately been collated with their catalogue, and were found correct. Many of the original observations are recorded in pencil memorandum-books. The books which are closed in each year are collected, under the three heads of Meridional, Extra-meridional, and Magnetic and Meteorological; and for each of these a box is constructed. Wooden portfolios are prepared for the large sheets, which are wrapped on the Chronograph Barrel, and receive the punctures given by the clock-seconds and the observing touch-piece. The manuscript copies of unpublished observations and calculations, which were referred to in the last report as lent to foreign astronomers, are still in their hands. They consist of various papers of Bradley and Bliss, and were communicated to Dr. Auwers and M. O. Struve. "Those who know the degree of adoration with which Bradley is regarded by the German astronomers will not," says Mr. Airy, "be surprised at the importance which they attach to these papers."

In reference to the various instruments at the Observatory, the Report shows us that all are in perfect order, and that the Chronograph-barrel, which had required some repair at the hands of Mr. Dent, is now in its usual working condition. We would, however, refer to an excellent suggestion which the Astronomer Royal has carried out in the examination of the co-efficient of sidereal aberration, and which is thus described in Mr. Airy's own words:—

"I alluded in the last report to a telescope whose tube should be filled with water, for examination of the co-efficient of sidereal aberration, when the pencil of light passes through a considerable extent of refracting medium. I have decided to use it in determining the apparent zenith-distances of γ Draconis at the proper seasons of the year. The instrument is in all important points completed. It is to be mounted upon the stone pier in the Occasional Observatory (formerly Struve's Observatory) now planted on the South Ground. The instrument admits of instantaneous reversion, with its micrometer in N. and S. positions; it admits also of being fixed with its micrometer in the E. and W. position, for determination of its scale. The construction of the instrument requires several unusual arrangements; amongst others, the means of cleaning the lower plate-glass from mud, and of clearing the internal surface of the object-glass from bubbles."

The Astronomer Royal's report on the magnetic operations at Greenwich are also full of interest; but it is to be regretted that Mr. Airy should still be obliged to confess that there are no self-registering electrical apparatus. The report, so far as it concerns the publications of the Observatory, is favourable, though it has to be admitted that no part of the M.S. for 1869 is yet in the printer's hands. Such delay may seem unreasonable to those ignorant of the subject, but astronomers will see in this caution of Mr. Airy's a just regard for advanced "reductions" of the observations.

Mr. Airy tells us that the Greenwich Observatory time ball has during the year been dropped "with unerring regularity and accuracy," and he gives some further information concerning the clocks in telegraphic communication with the Observatory which are most instructive. We think the report is, as we have said, most creditable to the Greenwich *chef* and his collaborateurs, and shows that the Observatory has maintained its place well as an observing establishment. Touching the general labours of the institution, we cannot do better than give the following quotation from Mr. Airy's annual report:—

"The practice of the Observatory remains faithful to its ancient traditions. With the meridional instruments we carefully observe, to the extent that appears necessary, 188 clock stars; Nautical Almanac, circumpolar, and occultation stars; stars favourable for examination of refraction, Argelander's, proper-motion, and variable stars; stars used in geodesy or any other pursuit; also, with the Reflex Zenith Tube, γ Draconis on every convenient day. Among the moveable bodies the Moon only is observed on every practicable day, without exception; the Sun and inferior planets on week-days; the large external planets when they transit before 15^h, and the small ones when before 13^h, but only for the first half of lunation,—M. Le Verrier and his successor, M. De Launay, having undertaken to observe them during the second half. With the Altazimuth, the Moon and proper stars are observed on every practicable night, and these are the only regular extra-meridional observations."

Primula Couttii.—Under the name of *Primula Couttii*, or Abyssinian Primrose, the Messrs. Veitch have recently exhibited at one of the meetings of the Royal Horticultural Society a handsome primrose, with tufted root, irregularly dentate oblong-lanceolate leaves, 8 in. to 10 in. long, and covered with white, mealy powder, especially on the lower surface. The flower-scape rises 18 in. in height, and bears two or three whorls of a dozen or more flowers, the whorls provided with leafy bracts, the lower ones being the largest, and the flowers yellow, salver-shaped, with a tube nearly 2 in. long, and a limb divided into five roundish notched lobes. This plant proves to be the *Primula simensis* of Hochstetter, a variety of the old *P. verticillata*, and will, therefore, bear the name of *P. verticillata simensis*. It is a very nice addition to our garden flowers.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

SCIENTIFIC men in Ireland are bestirring themselves for *their* field sports. Professor Hull and Mr. Symes, of the Irish Geological Survey, also Professors Dr. Traquair and Dyer, are about starting on a scientific tour in Auvergne. Professor Dr. Wyville Thomson is under engagement to proceed, with Dr. Carpenter and Mr. Gwyn Jeffreys, on another dredging expedition in the Atlantic. Professor W. King (on whom, by the bye, the senate of the Queen's University in Ireland has lately conferred the honorary degree of Doctor in Science—the *first* of the kind conferred in the sister isle) has just started, with his son, the Deputy Superintendent of the Madras Geological Survey, for the Hebrides and Highlands of Scotland; and Professor Dr. Perceval Wright is meditating some far-off journey.

If the meeting of the French Academy on the 30th ult. when Mr. Joule was elected to the place vacant by the death of M. Magnus as correspondent in the Section of Physics, the following was the return of the secret committee:—In the first line, Mr. Joule, of Manchester. In the second line and in alphabetical order, MM. Angström, of Upsala; Billet, of Dijon; Dove, of Berlin; Grove, of London; Henry, of Philadelphia; Jacobi, of St. Petersburg; Lloyd, of Dublin; Riess, of Berlin; Stokes, of Cambridge; W. Thomson, of Glasgow; Tyndall, of London; and Volpicelli of Rome. 43 members took part in the election, with the following result—Mr. Joule, 32 votes; Dr. Lloyd, 8; MM. Angström, Dove, and Volpicelli, one vote each.

In consequence of the 6th of June being Whit Monday, the next ordinary Meeting of the Society of Engineers will be held on Monday evening, 13th June, 1870, in the Society's Hall, Westminster Palace Hotel (north entrance). Adjourned discussion on paper read on the 2nd of May on "The Patent Laws," by Mr. W. Lloyd Wise. Should time permit, a paper will be read on "The Theory of Screw Propulsion," by Mr. Michael Sefi. The chair to be taken at half-past seven o'clock precisely.

The minute printed below has been adopted by the Council of the Statistical Society with respect to the census of 1871, and a copy of it forwarded to the Secretary of State for the Home Department:—"1. That it is not desirable to suggest any arrangements of detail in the mode of collecting the information, differing from those which have been observed generally, with great success, in the taking of the census on the last two occasions. 2. That it is advisable that the census of 1871 should be taken at the same time of the year as the last census. 3. Two collateral branches of inquiry were prosecuted in 1851, by means of the census machinery, but not under the compulsory powers of the statute. These related to—(*a*) The provision existing for religious worship and the attendance thereon. (*b*) The means existing for education, and the attendance at schools and places of instruction. The Council, in 1860, were of opinion that both these collateral subjects should be inquired into at the census of 1861, and made their recommendation accordingly in April, 1860. This recommendation was not adopted by the Government of the day. The Council having again considered this part of the inquiry, and having regard to the lapse of time since the investigation of 1851, think it expedient that the same subjects should, in like manner, be inquired into at the census of 1871. 4. They also are of opinion that the statute to be passed on the present occasion should further contain an express enactment, requiring that a distinct question should be inserted in every census schedule as to the religious persuasion of the persons included in that schedule. 5. That the statute should also require that the person filling up the schedule should state whether every individual mentioned therein, above the age of seven years, can read or write. 6. That inquiries to show the state of the house-accommodation of the people, on the basis adopted with so much success in the last census of Scotland, should be embodied in the next census returns for England."

It is announced by several journals, and among others by the *North German Correspondent*, that Dr. Oscar Liebreich, to whom we owe protagon and the now well-known chloral, has discovered a new anodyne, to which the name of chloride of Æthylide (*Aethylidenchlorid*) has been given. This substance, which has been repeatedly applied with perfect success in the clinical hospital of Dr. Langenbeck, is said to be more rapid and agreeable in its effects than chloroform. The chief merit, however, claimed for it is, that it may be administered without interfering with the free and natural breathing of the patient, an advantage which it possesses over most other anæsthetics. As the effect of the new body is stated to be very transient, the dose must be repeated in a lengthened operation.

The Irish *Daily Express* describes the report of the Royal Commission on primary education in Ireland as a scheme which would substitute for the present system, not merely one of denominationalism but of denominationalism on the basis of unlimited concession to the Ultramontane priesthood. It would altogether destroy the model schools; and "even the schools which would be ostensibly conducted on the mixed system would be placed to a greater extent than at present in the power of the priesthood." We believe however, (Ed. *S. O.*), that Sir Robert Kane's special report will be of quite a different character; and, as Sir Robert Kane is not only a Catholic but one of the originators, and also one of the presidents, of the Queen's Colleges, his views are much more likely to coincide with those of the Government than the denominational scheme above referred to.

The *Pall Mall Gazette* states that the authorities of Southampton have determined on the adoption of the A B C process of utilizing sewage and preserving the local waters from pollution. The necessary works will be commenced at once. Leeds, Halifax, Bolton, and several other towns have decided on the same course. The works at Hastings and Leamington have been in successful operation for some time.

The Rhododendron Show, at the Royal Botanic Gardens, on Saturday, was a decided success. Of the novelties displayed the most noteworthy are the Decorator, conspicuously placed near one of the entrances of the tent; the Loquendum, rose-coloured, with white centre; the Maroon, a very dark shade; the Meritorium, the Frederic Waterer, and the Pelopidas. All of these have claims upon the attention, which are not likely to be overlooked. Saturday was not a *fête* day at the Botanical Gardens, and the gaily-dressed and elegant crowd was wanting which on these occasions gives so much animation to the scene. But the grounds, in themselves, are sufficiently attractive to repay a visit at this season of the year; and Messrs. Waterer's magnificent collection of rhododendrons is worth a long journey to see.

We announced, some time since (on the authority of the *British Medical Journal*), that Dr. H. A. Nicholson allowed lady students to attend his lectures on Zoology, at Edinburgh. Some one, writing to the *Journal*, questioned the propriety of delivering ordinary comparative anatomy lectures to a mixed audience of young men and women; and to this Dr. Nicholson makes the following reply:—"In reply to a letter from an 'University Student,' which appeared in your last number, you will, perhaps, allow me to make a single remark. Being in no

way responsible for the paragraph to which your correspondent refers, I do not feel called upon to point out the inaccuracies of his statement. As he appears, however, in one respect, to be echoing a somewhat general belief, it may be perhaps as well that I should gratify his curiosity so far as to state, that the course of lectures on Zoology, which I am now delivering to a mixed class, is identically the same as the course which I delivered last winter to my ordinary class of male students. I have not hitherto emasculated my lectures in any way whatsoever, nor have I the smallest intention of so doing. In so acting, I am guided by the firm conviction that little stress is to be laid on the purity and modesty of those who find themselves able to extract food for improper feelings from such a purely scientific subject as Zoology, however freely handled. 'To the pure all things are pure.'"

There will be an examination at St. Peter's College on Tuesday, June 14th, for a Natural Science Scholarship, of the value of £60 per annum. It will be open to all persons who may desire to enter at the University. The subjects are—Chemistry, Comparative Anatomy and Physiology, and Botany. Names of candidates must be sent a week previously, to Rev. J. Porter, Tutor of the College, from whom further information may be obtained.

The Council of the Royal Society has recently voted some funds to Mr. C. Brooke, F.R.S., for the construction of a spectroscope to search for lines in the invisible rays beyond the red end of the spectrum. The instrument, says the *British Journal of Photography*, is now in course of construction by Mr. Browning, F.R.A.S., and the prisms, which are made of rock-salt, have already been ground, polished, and tested. As glass stops many of the ultra-red rays, it is necessary to use lenses and prisms of rock-salt. When the apparatus is finished, a spectrum will be projected on a screen, and then search will be made for the lines by means of a delicate thermo-electrometer, with a thermo-pile having a fine slit in front. It is found that the lines in the visible part of the spectrum contain no heat, so it is supposed that no rays of any kind fall at those points.

Three young ladies have, we believe, been admitted as students in the Vienna University, and one in the philosophical faculty of the University of Prague. It is stated that these ladies have already passed several of the ordinary university examinations with great credit.

Dr. H. Vogel, contributing the German correspondence to the *Photographic News*, gives the following interesting particulars of a new telescope for amateurs:—A day before my departure I was in Hamburg, and I saw an admirable telescope by Mr. Schroedèr, one of our best opticians—not only a practical, but also a scientific man. The telescope is designed for an amateur astronomer, M. le Baron von Bulow, residing near Kiel, and it is arranged, not only for eye-observations, but also for photographic purposes. The object-glass has a diameter of 300 millimetres, a focus of 5 metres, and gives a lunar picture of 45 millimetres, which is enlarged by an extra set of lenses from 80 to 200 millimetres. For making such a picture it is necessary to have a very fine clockwork, and Mr. Schroeder has introduced on his instrument two clockworks: one for rect-ascension, and one for declination, for following in the exactest manner the movements of the moon. I have proved this instrument only optically, and I can testify that I have never before seen such an excellent picture of the moon; it seemed as if formed from plaster, the different terraces of the ring mountains being admirably visible. Therefore, it would be very easy to take a photograph of the moon or of the planets, if there were not a fatal impediment—that is, the constant movement of our atmosphere. I made observations with Schroeder's telescope for about two hours. The heavens were quite bright, but I had only two or three moments in these two hours when the picture in the telescope was without trouble. This would not be trouble if the exposure was very short—perhaps instantaneous; but for making an enlarged moon picture, one must employ an exposure of about one minute; and if the atmosphere is only a little disturbed, it is impossible ever to take a sharp picture with the best instrument.

Under the well-known initials of "M. J. B.," the Rev. M. J. Berkeley contributes a very important note on "Parasitic Fungi" to the current number of the *Gardeners' Chronicle*. Speaking of the smut which attacks the anthers of *Lychnis diurna*, and which has been extremely prevalent this year, he says that, owing to the latter circumstance, he has been able to study it more effectually than hitherto. "Among myriads of plants," says this eminent fungologist, "we have found a single plant only of the male and female form respectively, in which, while some blossoms were attacked, a few escaped. In most cases every flower was equally affected. In the male plant, and this only in the white-flowered variety, which is quite distinct from *Lychnis vespertina*, the unaffected flowers were in their normal condition, with scarcely a trace of pistil. In the female plant, though the pistil was partially developed, but in no case, as far as we could find, fertile, the stamens were uniformly developed in the affected flowers, and the anthers filled with the spores of the Ustilago. In the unaffected flowers there were just the same rudiment of stamens as are always visible in unaffected plants, and no further development. It seems perfectly clear, therefore, that, when the female plant is traversed by the mycelium of the fungus, there is a tendency to cause the development of the stamens, which takes place at the expense of the pistil, which is much reduced in size. There is not the slightest ground for considering it a reversion, and the true explanation is undoubtedly that which is given in this journal, 1869, p. 1,110:—'The Ustilago penetrates the plant, but as it can only fructify in the stamens, it would appear to be the determining cause of the production of those organs in the normally female flower.' We have planted affected female plants, and we shall be very surprised if any of them prove truly hermaphrodite, should they not be attacked by the fungus. Amongst thousands of unaffected plants we have not found a single one, after a long search, which combines both sexes."

Mr. J. O. Byrne, an Irish barrister, has just published a very important treatise on the Irish Sanitary Laws.

The Rev. Churchill Babington, B.D., of St. John's College, Cambridge, has been re-elected to the Disney Professorship of Archæology, which he has already held for five years.

The Queen's University (Ireland) examinations for degrees begins on the 13th inst. A large number of candidates have presented themselves.

Speaking of the recent correspondence in the papers on the subject of the adulteration of beer, and referring to the able reports published some time ago in its own pages, the *British Medical Journal* says "it is absurd to speak of the water used in brewing as an adulteration, and to take the colour, or even the amount of spirit in beer, as being indications of its quality; and these errors, as well as the absurdity of the salting notion, are properly exposed in the reply of a chemist, published on Thursday. He shows, as we have long since done, that the spirit alone is not a measure of quality, but that the determination of the proportion of malt used in brewing may be taken as an index. Even in that case, beer made from sugar or molasses, instead of malt, may present the character of true beer, though it would not be regarded as equal to that made from malt. The results we have published in our reports show, moreover, that much of the beer sold in London is inferior to that obtained direct from the brewers, notwithstanding the heavy rate of profit that the publican obtains from high charges and small glasses."

Dr. Lyon Playfair gave away the prizes and delivered an address to the students of St. Mary's Medical School, on

Tuesday, 31st ult. He spoke at considerable length on the subject of public health, dwelling upon the large number of preventible diseases. Dr. Playfair also remarked on the necessity of improving the dwellings of the working poor; stating that if these were as healthy as the felon's cell, from eight to ten years would be added to the life of the former. It seems to be one of the features of this excellent hospital and school, that its prizes are each year given away by some one whose knowledge of educational questions stamps him as one having authority. Among those who have already assisted in this way, and whose addresses are printed in the prospectus of the school, are Professor Owen, Professor Huxley, the Archbishop of York, the President of the College of Physicians, the present Chancellor of the Exchequer, and Dr. Lyon Playfair.

The *Lancet* is grieved to say that Mr. Syme, the great Scotch surgeon, is suffering from another paralytic seizure. The attack, the fourth, we believe, which Mr. Syme has sustained, supervened on Tuesday, the 24th ult., and left the powers of speech and deglutition seriously impaired. He communicates his wants only by writing; but, according to the latest accounts, there is a slight improvement in his ability to swallow. He manifests much despondency as to his making an even moderate recovery; and his immediate attendants, we are sorry to learn, are hardly more hopeful of his case.

The following really practical suggestion is made by the *Echo*, and deserves the attention of the Government:—"Dirt is 'matter in the wrong place,' but a couple of islands in the Serpentine, to variegate its stiff and formal aspect, and to house the water fowl, would be dirt in the right place, and, now that the bed is being relaid, would cost next to nothing. We hope that Mr. Ayrton will act upon a suggestion, the merit of which is so obvious that we can only wonder why it has never been made before. How long is London to be the one and only metropolis which makes its streets in labyrinths of worse than artificial complexity, and lays out its ornamental land and water by rule and square? An island in the Serpentine might do something towards consoling the angry people for the land and trees which Hyde Park must lose if the Hall of Arts and Sciences and the Albert Memorial are to be squared with Kensington-road."

A telegram from Calcutta, dated May 31st, states that upwards of one hundred varieties of machines for the preparation of Rhea grass fibre are being sent in for the Government prize competition.

The Government of India has lately sanctioned the commencement of the Damoodah Canal, at an estimated cost of about £540,000. Its total length will be just one hundred miles. One end of it will terminate in the heart of the Bengal coal fields, and it will thus be the means of affording a cheap line of transport for carrying coals into Calcutta, relieving at the same time the railway of a portion of that traffic. A secondary but very important result of this canal is likely to be the drainage of the tract of land lying between the railway and the Damoodah, which, for the last seven years, has been desolated by malarious fever.

Mr. Thomas Nunneley, F.R.C.S., of Leeds, died last week, in his 62nd year. His name was most familiar to the public as a scientific witness, in which capacity he gave evidence in more than one famous poisoning case. His researches on the Calabar bean, and its physiological action, are familiar to most men of science.

A preliminary meeting has been held in Edinburgh for the purpose of inaugurating a movement for a national monument to Sir James Simpson. The Earl of Dalhousie presided. If, says the *Medical Times and Gazette*, a monument be erected in Edinburgh, we trust that the proposal for at least a bust in Westminster Abbey will not be abandoned. Simpson, although a Scotsman, was a man of whom Englishmen were justly proud. As was said of another great northern light, if only each person whom he has benefited by the discovery of chloroform gave sixpence to his monument, he would have a memorial which would be eclipsed by no royal mausoleum.

Dr. F. G. Bergmann has, in his *Résumé d'Études d'Ontologie Générale, &c.*, projected, from his own consciousness, the beings from which the human race developed itself. Their name, according to the Science Gossip of the *Athenæum*, is "Anthropiskes," and they lived in Central Africa. They developed out of apes; and a certain number of them, finding themselves in favourable circumstances, developed into men—black men, and became the parents of the families whence the brown, copper, yellow, and white races branched off. Dr. Bergmann has some equally original ideas on language. He complains that his works have not yet been appreciated, or even discussed; but he looks to the science of the future to do him justice.

The arrangements for the Horticultural division of the annual International Exhibitions, which are to commence in 1871 at South Kensington, are now receiving the attention of the officers of the Royal Horticultural Society, in whose hands mainly the management of this division is to rest. The *Pomologist* believes it is intended that there shall be bi-monthly exhibitions of horticultural objects, partaking very much, in fact, of the character of the excellent and highly-varied shows of the present season. These exhibitions are, however, to include and be supplemented by special prizes for various subjects, which prizes are to be offered at certain of the meetings for competition amongst foreign exhibitors only; while such arrangements will be made as will admit foreigners to compete for the Society's Certificates offered for new plants at all the meetings. Thus far, the international shows may be expected to represent augmentations of the present South Kensington meetings; but another feature is to be added, and one which affords to nurserymen and florists a special opportunity of advancing their interests. This is to consist of a permanent exhibition, in which the exhibitor is to take and fill to the best advantage for a given time—the whole period from May till October, or a part thereof—such a portion of the available space as he may find it convenient to undertake to occupy.

The *Pall Mall Gazette* gives the following interesting particulars concerning the Moabite stone:—After all the conflicting suggestions, hypotheses, decipherments, lectures, and the rest, which the Moabite stone has already produced, Mr. Deutsch at last appears with some clear and welcome tidings. While others were busy with their readings and renderings, he has, it seems, since his first letters in the *Times*, silently and intently kept his eye on the text itself, which now at *last is* slowly growing into definite shape. According to information received by him from Count de Vogüé, *about four-fifths* of the original will soon be deposited in the Louvre. Of course, nothing will remain to us but to give up our own little chips too, so that the monument may be restored as far as possible. All is not settled yet, however, as Mr. Deutsch proved by the chip obtained by Captain Warren some time before the squeezes, a chip which probably belonged to the defective right-hand corner; and, further, by certain lines partially copied by Mr. Klein, which, though of considerable importance (if correctly copied), have appeared neither in Captain Warren's nor in M. Ganneau's texts as yet. Mr. Deutsch also applauded the latter's perseverance and energy. Not only had he emended nearly all the passages pointed out to him as questionable in his previous text, but he had been steadily improving his copy by new corrections. Mr. Deutsch had received another new MS. instalment of emendations by M. Ganneau, affecting words in more than twelve lines. These, together with some other corrections, are to appear in the next *Revue Archéologique*. He also spoke of the comparative ease with which the monument will be read when a little more complete. Much valuable re-

search has already been accomplished regarding the reading, as well as the question of the date of Mesha, whom, it may be remembered, Mr. Deutsch was, from the very first, loth to identify without further proof with the Biblical Mesha. Indeed, as Professor Rawlinson said, Mr. Deutsch did good service to science by his warnings against hasty conclusions on the subject. While Mr. Deutsch did not touch upon the absurd doubts as to the genuineness of the stone, he spoke rather sharply against underrating the discrepancies in the readings of a few words, reminding his hearers of the importance attached to single letters and figures, not merely in Biblical, but also in other profane MSS., or, for the matter of that, in any commercial or legal document of our own day.

THE *Athenæum* is so well known to be inspired from a source hardly in the interest of the Anthropological Society, that we view anything it says on the subject of amalgamation with the Ethnological Society with some little distrust. We therefore desire our readers to accept the following quotation from that journal, *cum grano salis*:—The anniversary meeting of the Ethnological Society was chiefly remarkable for its bearing on the question of amalgamation with the Anthropological Society, one of considerable interest to the two societies and the scientific world. Professor Huxley for the first time gave his statement of the failure of the negotiations in 1868, dealing very gently with the late Dr. Hunt, but showing by documentary evidence that the responsibility of breaking off, when all was arranged, lay with the latter. The death of Dr. Hunt gets rid of the personal question, and the Fellows of the Ethnological and of the Anthropological Societies at their anniversary meetings have expressed strong opinions in favour of amalgamation. The question of finance offers no difficulty, and there is now no antagonism about publications, and a joint journal could be produced. The dispute about the name, if it cannot be conciliated, cannot be renewed. The Ethnological Fellows do not demand that their name be retained, but they positively refuse, and Professor Huxley indorses this refusal, to accept the name of Anthropological, after what has occurred; but they are ready to concur in any substituted name. As the negotiations were broken off by the Anthropological Society in 1868, the Ethnological Society have abstained from making overtures; but in consequence of the strong expressions at the Anthropological meeting, they have passed a formal resolution approving of their President's views as to amalgamation. Professor Huxley's address will be published as a declaration on this subject. The present obstacles are supposed to be owing to a portion of the Council of the Anthropological Society; but on looking to the present state of opinion, it is likely that all will co-operate in promoting the desired object.

THE members of the Royal Commission on Scientific Instruction and the Advancement of Science held their second meeting on Tuesday (31st ult.), at Devonshire House. Present—The Duke of Devonshire, K.G., chairman; the Marquis of Lansdowne; Sir J. Lubbock, Bart., M.P., F.R.S.; Sir J. P. Kay-Shuttleworth, Bart.; Mr. B. Samuelson, M.P.; Dr. Sharpey, Sec. R.S.; Professor Huxley, F.R.S.; Dr. W. A. Miller, Treas. R.S.; Professor Stokes, Sec. R.S.; and the Secretary, Mr. J. Norman Lockyer, F.R.S.

A PUBLIC meeting was held on Saturday at the Literary and Philosophical Society, Newcastle-upon-Tyne, to carry out arrangements for the meeting of the National Association for the Promotion of Social Science, which will be held in that town in the last week of September. The mayor, Mr. James Morrison, presided. The meetings of the Association will be held under the presidency of the Duke of Northumberland. A committee, with local secretaries, was appointed to collect the requisite funds and make the preliminary arrangements for the congress. Sir W. J. Armstrong, Mr. C. M. Palmer, and other large employers of labour, were among the speakers, and a handsome amount was subscribed towards the local expenses.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

ON THE ANCIENT IRON TRADE OF IRELAND.

BY G. H. KINAHAN, M.R.I.A., ETC.

IN THREE PARTS.—PART III.

BOATE asserts, that previous to the last years of Elizabeth's reign, there were no ironworks in Ireland; and thus vindicates his countrymen, while he abuses the Irish. "The Old-English in Ireland, that is, those who are come in from the time of the first conquest, until the beginning of Queen Elizabeth's reign, have been so plagued with wars from time to time, that they could scarce ever find the opportunity of seeking for mines, and searching out the metals hidden in the bowels of the earth. And the Irish themselves, as being one of the most barbarous nations of the whole earth, none of them all, great or small, at any time hath applied himself to that business, or in the least manner furthered it." These assertions evidently are incorrect, and were written under the prejudice so common then, and now, in many Englishmen, but more especially in those of that period, who wrote accounts of Ireland, many of them even going so far as to assert the Irish were such barbarians, that previous to the first English conquest, there were no such things in Ireland as stone and mortar structures! although their countryman, Geraldus Cambrensis, who came over with Strongbow, mentions them in his writings. Iron implements, as before observed, occur among the ruins of the habitations of the ancient Irish; and if these people did not understand the smelting and manufacture of the metal, they would scarcely have called places where its ores occur, after it. Even Boate has to acknowledge this; for he says, when writing of the Leitrim Hills that border Lough Allen, "where the mountains are so full of this metal, that thereof it hath got in Irish the name of Slew Neven, that is, *mountain of iron*." That this name could not have been given to it from the works carried on by the "New English" is evident, as we find it in "The Annals of the Four Masters," which was written before the mine was worked by the English. Furthermore, in the records for the year A.M. 3581, there is a lake mentioned that has the name of Loch-iairn (*Anglice*, iron lake), and many hills and other places in Ireland are named on account of the ores of this metal occurring in or at them. During the troubled times, between the first English conquest and the "long peace," all the works may gradually have ceased; but previous to that time, the inhabitants of Ireland must have been workers in iron; and if workers, it is almost certain that they also understood the manner of reducing its ores. Moreover, we find among the deities of the Tuatha-De-Danann, one of the earliest tribes that settled in Ireland—Brighit, the goddess of poets and *smiths*.

A revival of its iron trade would be one of the greatest boons that could happen to Ireland; however, although there is abundance of the ores there is a want of economical fuel. There is indeed a nearly inexhaustible supply of peat in her bogs and on her mountains; this, however, is, comparatively speaking, useless, as the economical value of it has never been developed, and it is now cut and saved as it was thousands of years ago. This state of things, moreover, is likely to continue unless inventors are encouraged and ways are discovered to cut, dry and compress peat by machinery, both expeditiously and cheaply. In mineral-fuel, Nature has dealt hardly with Ireland; for, although the greater part of her subjacent rocks belong to the carboniferous period, yet she has no really productive coal-field. Geologists, who deal more in speculative theories than in facts, assert that at one time over her present rocks there were extensive coal-bearing measures which have been removed by the

force of denudation. This, to a certain extent, may be correct, as part of her coal-measures have undoubtedly been removed, but there is no data from which it can be positively asserted or even conjectured that the Irish coal-measures ever, before they were denuded, contained much coal. Would not the facts, as they now appear, seem to point to opposite conclusions? In the centre of England (South Staffordshire), during the carboniferous period, no rocks were deposited, except true coal-measures, containing a vast thickness of coal; but in Ireland during the same period various non-coal-bearing rocks were being deposited. In her central portions, limestones; in the south-west, a large accumulation of grits, shales, &c.; while in the north, rocks identical with those forming the different groups of the carboniferous period (coal-measures, limestones, and the so-called old-red sandstone) were mixed up together. The alteration in the deposition of these rocks are even to be found much further south, as the late F. J. Foot, M.A., &c., records in the *Memoirs of the Geological Survey*,—in the north part of the co. Clare—that is, the north extremity of the Munster coal-field, that the coal-beds found further south, north and south of the bay called the Mouth of the Shannon, and also further south, in the cos. Limerick and Cork, are wanting; also that there is a thin bed of limestone containing carboniferous limestone fossils high up in the coal-measures.

If the enormous time it must have taken for the South Staffordshire coal-measures to accumulate be calculated, does it not appear probable that the formation of these rocks occupied the time and were being formed, while in the neighbouring countries limestones were being deposited; or, as in the south-west of Ireland and England, massive series of grits, shales, &c.?[1]

The Irish carboniferous limestone and Devonian rocks are for the most part nearly without mineral veins, while in England rocks of the same ages contain numerous veins, rich in such minerals as chalcopyrite, tetrahedrite, redruthite, stannite, cassiterite, galenite, and sphalenite; and if these Irish rocks were formed nearly destitute of those minerals, why may not the Irish coal-measures have been deposited wanting nearly all their coal?

Why may not the central division of the Irish carboniferous limestone (called by Sir R. Griffith, Bart., *calp*) represent an effort of nature to form a coal-measure series in the country that is now Ireland, at an earlier time in the carboniferous period? For many of the grit and shale occurring in it are scarcely distinguishable from those of the true coal-measures. If the land, as did happen, instead of continuing to rise, began again to sink, the succeeding age consequently was favourable to the deposition of another series of limestone rocks; therefore until the land again rose (comparatively speaking towards the close of the carboniferous period), conditions favourable to the deposition of the true coal-measure could not have existed in that country.

[1] The late J. Beete Jukes, F.R.S., Director of the Irish Branch of the Geological Survey, was convinced that the grits, shales, &c., of Devonshire and Cornwall are of the same age as the rocks in the west of Cork and Kerry; while the latter rocks, for the most part, are undoubtedly of similar age to the carboniferous limestones of the central plain of Ireland, as they lie on the same geological horizon.

ON STAR-GROUPING, STAR-DRIFT, AND STAR-MIST.

BY RICHARD A. PROCTOR, B.A., F.R.A.S.

IN THREE PARTS.—PART III.

AS indicative of other laws of association bearing on the relations I have been dealing with, I may mention the circumstance that red stars and variable stars affect the neighbourhood of the Milky Way or of well-marked star-streams. The constellation Orion is singularly rich in objects of this class. It is here that the strange "variable" Betelgeux lies. At present this star shows no sign of variation, but a few years ago it exhibited remarkable changes. One is invited to believe that the star may have been carried by its proper motion into regions where there is a more uniform distribution of the material whence this orb recruits its fires. It may be that in the consideration of such causes of variation affecting our sun in long past ages, a more satisfactory explanation than any yet obtained may be found of the problem geologists find so perplexing—the former existence of a tropical climate in places within the temperate zone, or even near the Arctic regions.[1]

It remains that I should exhibit the general results to which I have been led. It has seemed to many that my views tend largely to diminish our estimate of the extent of the sidereal system. The exact reverse is the case. According to accepted views, there lie within the range of our most powerful telescopes millions of millions of suns. According to mine, the primary suns within the range of our telescopes must be counted by tens of thousands, or by hundreds of thousands at the outside. What does this diminution of numbers imply, but that the space separating sun from sun is enormously greater than accepted theories would permit? And this increase *implies* an enormous increase in the estimate we are to form of the vital energies of individual suns. For the vitality of a sun, if one may be permitted the expression, is measured not merely by the amount of matter over which it exercises control, but by the extent of space within which that matter is distributed. Take an orb a thousand times vaster than our sun, and spread over its surface an amount of matter exceeding a thousandfold the combined mass of all the planets of the solar system:—So far as living force is concerned, the result is—*nil*. But distribute that matter throughout a vast space all round the orb:—That orb becomes at once fit to be the centre of a host of dependent worlds. Again, according to accepted theories, when the astronomer has succeeded in resolving the milky light of a portion of the galaxy into stars, he has, in that direction, at any rate, reached the limits of the sidereal system. According to my views, what he has really done has been but to analyze a definite aggregation of stars, a mere corner of that great system. Yet once more, according to accepted views, thousands and thousands of galaxies, external to the sidereal system, can be seen with powerful telescopes. If I am right, the external star-systems lie far beyond the reach of the most powerful telescope man has yet been able to construct, insomuch that perchance the nearest of the outlying galaxies may lie a million times beyond the range even of the mighty mirror of the great Rosse telescope.

But this is little. Wonderful as is the extent of the sidereal system as thus viewed, even more wonderful is its infinite variety. We know how largely modern discoveries have increased our estimate of the complexity of the planetary system. Where the ancients recognized but a few planets, we now see, besides the planets, the families of satellites; we see the rings of Saturn, in which minute satellites must be as the sands on the sea-shore for multitude; the wonderful zone of asteroids; myriads on myriads of comets; millions on millions of meteor-systems, gathering more and more richly around the sun, until in his neighbourhood they form the crown of glory which bursts into view when he is totally eclipsed. But wonderful as is the variety seen within the planetary system, the variety within the sidereal system is infinitely more amazing. Besides the single suns, there are groups and systems and streams of primary suns; there are whole galaxies of minor orbs; there are clustering stellar aggregations, showing every variety of richness, of figure, and of distribution; there are all the various forms of nebulæ, resolvable and irresolvable, circular, elliptical, and spiral; and lastly, there are irregular masses of luminous gas, clinging in fantastic convolutions around stars and star-systems. Nor is it unsafe to assert that other forms and vari-

[1] Sir John Herschel long since pointed to the variation of our sun as a possible cause of such changes of terrestrial climate.

eties of structure will yet be discovered, or that hundreds more exist which we may never hope to recognize.

But lastly, even more wonderful than the infinite variety of the sidereal system is its amazing vitality. Instead of millions of inert masses, we see the whole heavens instinct with energy,—astir with busy life. The great masses of luminous vapour, though occupying countless millions of cubic miles of space, are moved by unknown forces like clouds before the summer breeze; star-mist is condensing into clusters; star-clusters are forming into suns; streams and clusters of minor orbs are swayed by unknown attractive energies; and primary suns, singly or in systems, are pursuing their stately path through space, rejoicing as giants to run their course, extending on all sides the mighty arm of their attraction, gathering from ever new regions of space supplies of motive energy, to be transformed into the various forms of force,—light, and heat, and electricity,—and distributed in lavish abundance to the worlds which circle round them.

Truly may I say, in conclusion, that whether we regard its vast extent, or its infinite variety, or the amazing vitality which pervades its every portion, the sidereal system is, of all the subjects man can study, the most imposing and the most stupendous. It is as a book full of mighty problems,—of problems which are as yet almost untouched by man, of problems which it might seem hopeless for him to attempt to solve. But those problems are given to him for solution, and he *will* solve them, whenever he dares attempt to decipher aright the records of that wondrous volume.—*Lecture before the Royal Institution.*

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From May 22nd to June 4th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 White-backed Piping Crow (Gymnorhina leuconota)	South Australia ...	Presented by J. F. Blackmore, Esq.	Parrot-house
1 Naked-throated Bell Bird (Chasmorhynchus nudicollis)	Brazil	Purchased.....	Ditto
1 White-crested Touracou (Corythaix albo-cristata	South America.....	Ditto.....	Western Aviary
7 Dufresne's Waxbills (Estrelda Dufresnii)	Natal.....	Ditto.....	Parrot-house
1 Red Waxbill (Estrelda minima)	West Africa.....	Ditto.....	Ditto
5 Long-tailed Weaver Birds (Chera progne)	South Africa.....	Ditto.....	Western Aviary
2 Red-shouldered Weaver Birds (Euplectes axillaris)	Ditto.....	Ditto.....	Ditto
2 Common-crowned Pigeons (Goura coronata) ♂ ♀	New Guinea.....	Ditto.....	Ditto
2 Red-tailed Finches (Estrelda bella).....	Australia	Ditto.....	Parrot-house
1 Yarrell's Curassow (Crax carunculata) ♀	South America.....	Ditto.....	Eastern Aviary
1 Razor-billed Curassow (Pauxi mitu) ♂	Tropical America...	Ditto.....	Ditto
1 Globose Curassow (Crax globicera) ♀	Honduras.....	Ditto.....	Ditto
1 Solater's Curassow (Crax Solateri) ♀	South America.....	Ditto.....	Ditto
1 Prince Albert's Curassow (Crax Alberti) ♀	Brazil	Ditto.....	Ditto
2 Cinereous Sea-Eagles (Haliaëtus albicilla).....	Europe	Presented by the Hon. A. C. Littleton, R.N.	Eagles' Aviary
1 Spotted Ichneumon (Herpestes auropunctatus ♂	Bengal	Purchased.....	Small Mammal House
3 Buff Laughing Kingfishers (Dacelo cervina)* ...	North Australia ...	Ditto.....	Western Aviary
2 Common Partridges (Perdix cinerea)	British Islands.....	Presented by Miss C. Puddick	Pheasantry
10 Summer Ducks (Aix sponsa)	.....	Hatched in the Gardens	North Pond
2 Red-breasted Guans (Penelope pileata)	South America.....	Purchased.....	Eastern Aviary
1 Grey Ichneumon (Herpestes griseus).....	India.....	Presented by Captain Crozier	Small Mammal House
1 Rufus-necked Wallaby (Halmaturus ruficollis) ...	New South Wales ..	Presented by G. M. Roberts, Esq.....	Kangaroo-sheds
1 Eyed Lizard (Lacerta ocellata)	South Europe	Presented by Wm. Tait, Esq.	Reptile-house.
1 Turnstone (Strepsilos interpres).....	Europe	Ditto.....	Fish-house
1 Whimbrel (Fumenius phœopus)	Ditto.....	Ditto.....	Ditto
1 Common Otter (Lutra vulgaris)	British Islands.....	Presented by Captain De Winton, F.Z.S.	Otter's Pond
1 Tiger (Felis tigris)	Eastern Asia	Presented by C. A. Goodfellow, Esq.....	Carnivora-dens
1 Markhoor (Capra megaceros)	.....	Born in the Menagerie	Goat-sheds
1 Ashy-black Ape (Macacus ocreatus)	Celebes'.....	Purchased.....	Monkey-house
1 Marsh Ichneumon (Herpestes paludosus)	South Africa.....	Ditto.....	Small Mammal House
2 Great Eagle Owls (Bubo maximus).....	Southern Spain ...	Deposited by Major Howard Irby	Owl's Aviary
1 Common Wolf (Canis lupus)	Ditto.....	Ditto.....	Small Mammal House
1 Booted Eagle (Aquila pennata)	Ditto.....	Presented by Major Howard Irby.....	Eagles' Aviary
2 Pike (Esox lucius).....	British Fresh Waters	Presented by A. G. Kemp, Esq., F.Z.S.	Fish-house
1 Slender-billed Cockatoo (Licoñetis tenuirostris)...	South Australia ...	Presented by Mrs. Fred. Taplin.....	Parrot-house
1 Senegal Touracou (Corythaix persa)	West Africa.....	Purchased.....	Western Aviary
1 Marsh Ichneumon (Herpestes paludosus)	South Africa	Ditto.....	Small Mammal House
A Collection of Marine Animals.....	British Seas	Ditto.....	Fish-house
2 Common Trumpeters (Psophia crepitans)	Demerara	Presented by Captain F. A. Ball	Eastern Aviary
1 Yellow Snake (Chilobothrus inornatus).....	Jamaica	Presented by Joseph Smith, Esq.	Reptile-house
2 Peacock Pheasants (Polyplectron chinquis)	.....	Hatched in the Gardens	Pheasantry
3 Java Sparrows (Padda oryzivora)	Java	Purchased.....	Parrot-house
2 Spotted-sided Finches (Annaduis lathamii)	Australia	Ditto.....	Ditto
1 Macaque Monkey (Macacus cynomolgus)	India.....	Deposited by F. C. Webb, Esq.....	Monkey-house
1 King Parrakeet (Aprosmictus scapulatus).....	New South Wales	Presented by Mrs. A. Hughes	Parrot-house
1 Common Blue Bird (Sialia Wilsonii)	.....	Hatched in the Gardens	Western Aviary
1 Sun Bird (Eurypyga helias).....	.....	Ditto.....	Ditto

♂ Male. ♀ Female. * Never previously exhibited.

Microscopic Crystals in Gems.—In connection with the excellent paper which Mr. Sorby some time since communicated to the *Monthly Microscopical Journal*, we would call attention to a very instructive memoir which, though it was read nearly twelve months since before the Philadelphia Academy of Natural Sciences, has only recently been published, and unfortunately, too, without figures, if we may judge from the proof-sheets which have reached us. In a previous paper the author describes his observations on Garnets. In this he remarks on the microscopic structure of Sapphire, Garnets, Labradorite, Black Felspar, Baryte, Amethyst, and Ruby.

THE CHEMISTRY OF THE CARBON PROCESS.

BY JOSEPH W. SWAN.

BICHROMATE of potash, like nitrate of silver, when in a pure state, does not suffer any alteration under the influence of light; but when it is mixed with organic matter the case is different. If, for example, a sheet of paper be washed with a solution of bichromate of potash, and exposed to light, the paper changes colour, thereby indicating that bichromate, *in contact with paper*, is liable to decomposition by solar action. A mixture of gelatine and bichromate of potash is susceptible of change, by the action of light, from a state of solubility in warm water to a state of insolubility. This fact consitutes the basis of carbon printing, and on that account alone the nature of the action which produces this result well deserves to be carefully studied. But its importance is greatly increased by the circumstance that the action of light upon bichromated gelatine is not limited to the rendering of the gelatine insoluble, but is attended by several other changes, which can be made, and are made, subservient to the production of pictures in a great variety of ways; indeed, I know of no photo-chemical action so prolific of photographic processes as that which takes place between the salts of chromic acid and gelatine and other analogous substances.

When I first applied myself to carbon printing, the nature of the chemical change, in virtue of which the gelatine becomes converted from a condition of solubility into one of insolubility, was not understood, and the obscurity which then prevailed with regard to it very greatly increased the difficulties inherent to the process; in fact, if I had not, at an early stage of my experiments, possessed myself of this key to the cause of the many irregularities which attended the process, I think I should have entirely failed to make it practicable. It was quite *essential*, in order to make the process practically successful, that the means of making the gelatine tissue *uniformly sensitive and invariably and freely soluble* before exposure to light should be understood and under control; and to this end the chemistry of the process required to be known. At the outset of my experiments, I found that my sheets of bichromated gelatine were liable and apt to become totally insoluble during the process of drying. When all the sheets of tissue prepared with one kind of gelatine or with one kind of colour were soluble, while those prepared with a different kind of gelatine, or with a different colour, were insoluble, there was, to some extent, a tangible cause for the difference of result; and one could escape from this difficulty by using that kind of gelatine and those colours which had been proved, by experiment to be compatible with a soluble condition of the tissue. But it was far from being satisfactory to work in this blindfold sort of manner. It restricted one very annoyingly in the use of materials, and even with every care there were puzzling irregularities and frequent failures; often sheets which had been prepared exactly alike, with the same gelatine mixture and in a precisely similar manner in every respect, would greatly differ in solubility: some would be freely soluble, while others were totally insoluble. In this case it was of course obvious that there *must* have been *some* difference in the *circumstances under which* the different sheets were *prepared* or *dried* to account for this difference in their condition as to solubility; for "nothing comes out of nothing." Accordingly, upon careful examination, I found that, so long as the sheets were wet, a change, similar to the change which light produces, was gradually going on, and that this change became comparatively rapid when the sheets nearly approached to dryness; and I also found that heat accelerated the decomposition, which finally resulted in the sheets becoming insoluble, and that if soluble sheets were kept in a perfectly dry atmosphere their becoming insoluble was greatly retarded.

These observations aided me to a very large extent. Knowing thus much of the conditions under which the tissue became insoluble, I could generally so manage the drying as to be able to rely upon the solubility of my tissue. Still there were times when, without apparent cause, the tissue would be insoluble as soon as dry; moreover, it was not always alike in *sensitiveness;* not unfrequently it would be superficially insoluble; that is to say, the exterior surface, to an almost inappreciable depth, would be insoluble, giving the pictures produced from it a tinted appearance, as if they had been printed upon old, discoloured silvered paper. These irregularities led me to endeavour to discover the nature of the reaction which determined the formation of the insoluble gelatine compound. In this research I was guided by the knowledge that chromic acid and soluble chromates and bichromates are very easily decomposed by substances having an affinity for oxygen, such substances taking oxygen from the acid, and reducing it to a lower state of oxidation, and, when the reduction is complete, changing the character of the chrome compound from that of an acid to that of a base. This metamorphosis is readily produced by the action of oxalic, tartaric, and citric acids, and by various other substances. In the case of chromic acid and bichromate of ammonia, heat alone is sufficient to cause the *evolution* of that portion of oxygen which it holds so feebly, and the possession of which constitutes it an acid, and the loss of which destroys its acid character, reducing it to the condition of a base. I was also acquainted with the fact that gelatine enters into combination, and forms insoluble compounds with certain metallic oxides; and I hence thought it not improbable that the insoluble gelatine compound, with which I had been dealing in the carbon process, might possibly be a combination of gelatine with reduced chromic acid—that is to say, of gelatine with chromic oxide, or with a salt having chromic oxide for its base. I accordingly tried the effect of adding such a salt to a solution of gelatine, and I found that, under its action, a hot solution of gelatine presently solidified to a firm jelly, which could not be reliquified by further heating, and which was totally insoluble in hot water. This experiment threw great light upon the chemistry of the process, and it, together with other observations, led me to the conclusion that *gelatine, aided by light, reduces the chromic acid of the bichromate* to a lower state of oxidation, and then enters into combination with a compound of chromic oxide produced by the mutual decomposition of the chromic acid and gelatine, the consequence being the formation of the leather-like substance with which we are now so familiar in carbon printing. Incidental to these changes a portion of gelatine is decomposed, and carbonic acid, and probably also an organic acid are produced.

I found the addition of sugar to the mixture of gelatine and colour to favour the reduction of the chromic acid; and I think it not improbable that, when sugar forms one of the components of the tissue, it, rather than the gelatine, may appropriate the oxygen of the chromic acid, and in that case saccharic or oxalic acid would probably be formed.

According to my experience, neither glucose nor glycerine can be advantageously substituted for sugar in the mixture of gelatine and colour; both tend to induce insolubility, or to greatly retard solubility. Glycerine has a very peculiar action.

I found that the chromo-gelatine compound was soluble in solution of chloride of lime and in peroxide of hydrogen.

After ascertaining these facts, the causes of many failures were apparent, and the proper remedies could be applied; for example, that most embarrassing difficulty which I have mentioned of the sheets of tissue being superficially decomposed in process of drying, and producing tinted pictures, was completely obviated by placing a small quantity of chloride of lime (bleaching-powder) on the floor of the room in which the tissue was dried. Knowing the *rationale* of the process, this remedy naturally suggested itself, but without that knowledge the difficulty would have remained.

Acquaintance with the chemical principle upon which the conversion of gelatine from a soluble to an insoluble condition

depended, enabled me to calculate the effect of different pigments, and of impurities in the various materials employed; and where these were of a nature to prejudice the success of the process, either to neutralize their effect by suitable additions, or, where that could not be done, to discard the unsuitable materials.

In a thousand ways I was assisted by a knowledge of the chemistry of the process, and I have no doubt the facts I elicited respecting it may be usefully applied to other kindred processes.

Before closing these remarks, I should like to say a few words with reference to the discovery of carbon printing. In the paper which I read before the Photographic Society six years ago, I attributed the *discovery*, or rather the *invention*, of carbon printing to Mr. Ponton. I think that was a mistake. Undoubtedly Mr. Ponton was the first to suggest and show the application of bichromate of potash to the purposes of photography, but I believe he did not propose to apply it as a means of photographic printing *in carbon*. It is, I think, indisputable that this idea was the conception of M. Poitevin, one of the most laborious and original of all the pioneers of photographic progress. I take this opportunity of correcting my error, and in doing so I feel much pleasure in acknowledging my obligation to M. Poitevin as the originator of the *fundamental idea* of carbon printing. It was a true invention, not a discovery; there is a wide difference. A discovery may be no more than a happy accident; but an invention is an act of imagination, and places a man in fellowship with the greatest of his kind.—*The Photographic Journal.*

THE EFFECT OF POWERFUL MAGNETS ON MAN AND THE LOWER ANIMALS AND PLANTS.

BY JOHN VANSANT, M.D.,

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IN THREE PARTS.—PART I.

MY attention was first particularly directed to the subject of this communication in the winter of 1866, when I observed that a small, magnetized steel rod, the *ends of which were finely pointed*, if brought carefully in contact with an exquisitely-sensitive blister, that had been accidentally produced on one of my fingers by pinching it, gave rise, when the southward pole was applied, to a momentary sharp sensation, and seemed to cause the blister to be more painful after the magnet was removed. When the northward pole was used in the same way, no sensation could be felt at the moment of contact, and after removal the original pain remarkably subsided. Struck by this phenomenon, and yet almost doubting my own sensations, I proceeded to inquire if it were possible to recognize a difference between the two ends of the magnet by means of some organ peculiarly sensitive in its normal condition. On trial, I found that the conjunctival membrane of the eye would indicate by the feeling which pole it was touched with. I could lay with care the sharpened northward end of the magnetic rod on that membrane without pain or winking; but the instant the southward pole was applied, no matter with how much delicacy, there was a sharp sensation and an involuntary slight closing of the eyelid. The effect was faint, but plain. This experiment was repeated on the eye of another person, the same day, with similar results. After this I made numerous experiments with magnets of different forms and powers (though not at any time with very large ones) applied to various parts of the body, and thought I observed a definite set of symptoms arise after every application in the same manner to a given part, provided sufficient time had elapsed between the applications for the organ to resume its ordinary state. Finally, I became convinced of the genuineness of the phenomena, that they were not to be attributed to the imagination, and that they were as regular in their occurrence and quite as persistent as those following the adminstration of any medical substance. But to produce this conviction in others, and especially to give assurance to the broad statement that *magnetism has power to affect the functions of living beings*, it was very desirable to get some demonstrative evidence that might be apparent to any person, whether sensitive or not, and to a number of persons at the same time, and that should not depend entirely on testimony; in other words, it was necessary to establish the fact by the same kind of evidence that establishes any scientific fact. This, I believe, I have succeeded in doing; and I offer the following typical experiments, which can easily be repeated, as the proof.

Experiments upon Vegetables.—1. I took for experiment three small flourishing tulips (*Tulipa gesneriana*) in full bloom, flowers red, growing in the same pot within four inches of each other. These plants, which I shall designate as A, B, C, were about equally vigorous, almost exactly of the same size, and were watered and kept in a light room at a genial temperature. If there was any advantage in vigour, it was in favour of A. By means of a steel-bar magnet, capable of lifting with one pole about an ounce of iron, I applied *Boreal* (+) magnetism—the southward end—to tulip A, drawing the pole slowly from the surface of the soil in the pot to the top of the plant along the stalk and larger leaves, and repeating this manœuvre for about three minutes. I then made a similar movement over tulip B, but substituted *Austral* (—) magnetism—the northward end—for that first used. Tulip C was left untouched. Almost immediately there was a contraction or shrivelling of the *petals* visible in both of the plants touched, but especially in A. Soon, however, the contraction disappeared from B, while in A it continued unabated. About twelve hours afterwards I placed a small straight magnet, some four inches long by one-sixth of an inch in diameter, so that its + pole resting against the scape of A, and its — pole against that of B, should keep up the same kind of magnetic action as first applied; and the instrument was left in this situation for thirty-six hours.

At the end of that time the flower of A was very much withered and evidently dying, the leaves of the plant were curled, the healthy green colour was faded, and the whole had a declining aspect. The flower and leaves of B, on the contrary, looked equally as fresh and of as good colour as those of C, which were untouched by the magnet; and even, I think, the flower was more expanded and the red of a deeper shade. After about eighty hours from the beginning of the experiment the flower of A was quite dried up, while that of B, though more shrivelled than C, was far less withered than A. The green leaves of B appeared just as healthy as those of C, but the leaves of A were more than ever curled and pale.

2. I applied *Boreal* (+) magnetism, by means of the same magnet used in the first experiment, to stem and flowers—red—of a small, thriving geranium (*Pelargonium zonale*). The instrument was drawn slowly, for about two minutes, upwards, from two inches above the soil in the pot, along the stem to the top of the umbel, a distance of, say, six inches. The *petals* immediately contracted, their edges curled, the colour became paler, and their perfume was momentarily excited; but, in three or four minutes after the application ceased, the flowers were temporarily expanded more than in the beginning, and the colour was brighter. In four or five hours the flowers were plainly withering, and in 24 hours the petals were quite contracted and a number of them had fallen off. The large green leaves also appeared as if they had been slightly frost-bitten. Two days after the above, this geranium, to which I had in the interim several times applied the same + magnetism, seemed actually invigorated by it, and began putting out new

leaves, thus seeming to have become accustomed to the influence.

3. At the same time, by the same means used in the last experiment, and in a like manner, I applied *Austral* (—) magnetism—the northward end of the magnet—to a verbena-plant (*V. aubletia*) in flower. While the magnet was touching the plant there was little, if any, contraction of the petals, but one minute afterward they were curled, and this persisted a considerable time. In four or five hours the flowers showed signs of reviving, and, at the end of 24 hours, though not as perfect as at first, they presented a tolerably fresh appearance. The green leaves retained their usual colour and form pretty well. Two days afterward the whole plant looked feeble; the flowers gradually faded and fell before their normal time. I then applied + magnetism to the stalk and to some buds, and this seemed to infuse, temporarily at least, new vigour, and I could see the buds *slightly* expand in a *few minutes.—The (American) Journal of Psychological Medicine.*

IS ANY KNOWLEDGE USELESS?

In Two Parts.—Part II.

It is well known that elm trees, as well as apple trees, in certain localities in the United States, are sometimes eaten almost bare by that common looping caterpillar called the canker-worm; and that these worms have been checked and controlled by those who are acquainted with their peculiar habits, by fastening leaden troughs of oil round the butts of the trees. Like the larvæ of many other moths, this worm buries itself under the ground to change into the pupa state; but, unlike the great majority of moths, the perfect male has wings, and the perfect female has no wings at all, and is therefore compelled to crawl up the trunks of the trees to deposit her eggs, instead of flying on to the trees, as almost all other insects have the power of doing when in a perfect state. Hence the philosophy of the practice above alluded to, which depends for its efficacy on this trait in the natural history of the canker-worm. Not very long ago, the elm trees which ornament the city of Baltimore were attacked by a larva that stripped them bare. Supposing it to be the notorious canker-worm, the corporate authorities spent a good many hundred dollars in fixing leaden troughs filled with oil, after the most approved fashion round their trees. They might just as well have built a tight board fence round a corn-field to keep out the crows and blackbirds. The insect that was afflicting their trees was not the canker-worm, but the larva of a beetle (*Galeruca calmariensis*) imported by some chance or other from Europe, where it often strips the elm trees in the same way; and, unfortunately for the City Fathers of Baltimore, the female of this beetle has wings, and was not in the least inconvenienced by the oil troughs. A little time spent in investigating the habits of this beetle would have saved them all their trouble.

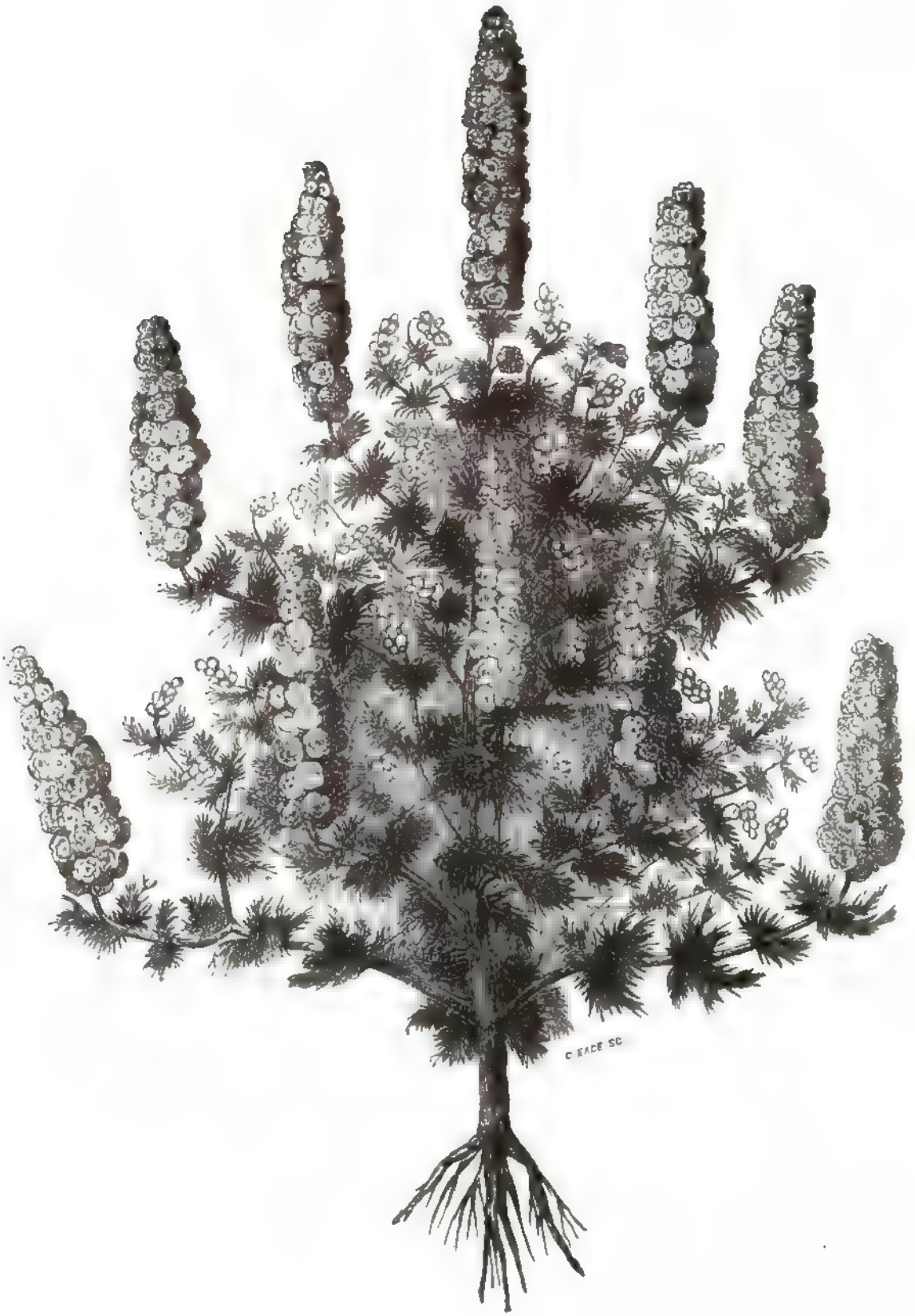
A similar instance of just such entomological folly occurred a couple of years ago in Southern Illinois. A certain fruit-grower in Union county, for lack of a proper knowledge of the habits of that little pest, the Curculio, took it into his head that this insect had no wings and could not fly, and that it could only reach the fruit in consequence, by climbing up the tree. Hence he very sapiently went to work and fixed a band of wool around every tree in a large orchard containing about 10,000. Now, as the Curculio has ample wings, and can fly with the greatest ease, this procedure was of no earthly use in protecting this worthy fruit-grower's peaches. He might just as well have wrapped the wool round his stove-pipe under the delusive idea that he could thereby keep the flies and mosquitoes out of his house.

There is a small timber-boring beetle—called *Limexylon navale*, or, in English, the Naval Timber-pest—which is very common in the oak forests of the north of Europe, and occasionally occurs in such numbers in the Swedish and French dockyards as to do a prodigious amount of damage. About one hundred years ago the Swedish Government found out that this insect was doing millions of dollars' worth of damage in their dockyards by boring the timber full of holes, so that if it had been put into a ship, it would have let the water in like a sieve. The Swedish Government concluded that it wouldn't answer to have such a heavy annual loss; and they did the very wisest thing that they possibly could have done. They applied to the celebrated Linnæus—the father of the science of entomology—though to many, perhaps, he is only known as a great botanist. Linnæus took the matter in hand; and, having investigated the habits of the insect, discovered that it came out of the timber in the perfect or winged state in one particular month only (June), when it flew around, paired, laid its eggs on any oak timber to which it had access, and shortly afterwards perished. So he said to the Swedish Government: "Gentlemen, all you have to do is to sink all your oak timber under water during the month of June, so that the female beetle may not be able to deposit her eggs on it; and *you will be no more* troubled for a great many years to come with *Limexylon navale*." The Government did so; and the result was just what Linnæus had predicted. Dr. Harris informs us that, not very long afterwards, the insect occurred in similar profusion in a French dockyard; and although a naval officer, who was also a good entomologist, suggested the Linnæan remedy to the authorities, they neglected to apply it—having, perhaps, the common unfaith in science, and thinking, with the vulgar, that the study of bugs was all a humbug. As might have been expected, they reaped the reward of their ignorance, and suffered an immense amount of valuable timber to be destroyed by this insect, which might just as well have been saved.

Such instances might be multiplied *ad infinitum*, but we forbear, and take consolation in the fact that a new era is dawning. There were men who had no faith in Fulton and his steamboat. There were men who had no faith in Morse and his electric telegraph. There were men who had no faith in Stephenson and his locomotive. But if Fulton, and Morse, and Stephenson had themselves had no faith, or had suffered themselves to be laughed down by the criticisms of the would-be wits and can't-be philosophers, the world would not now be where it is. The law of the age is progress. "The point that yesterday was lost in the dim far-away distance becomes our goal to-day, and will be our starting-point to-morrow."—*The American Entomologist and Botanist.*

A DWARF LARKSPUR.

We dare say our readers will excuse our introducing to their notice another of the plants from Messrs. Dick Radclyffe & Co.'s nurseries, as the plant is one which we feel sure is destined to become a favourite. It is (see figure on opposite page) a variety of *Delphinium consolida* (the stock-flowered larkspur). It forms a pretty bush of innumerable branches, resembling a candelabrum in form from the ground, and rises in a symmetrical pyramid to the height and breadth of 1 ft. The flowers are well filled, and hang in elegant, rich branches on the candelabra-shaped branches, in beautiful order, and continue in full blossom till late in the autumn. The foliage adds much to its rich effect; its fine leaves grow in compact form, principally on the middle stems, graduating in less dense masses towards the flowers. The colours, being constant, are classed as follows:—blackish blue, violet, rose, light blue, tricolor, white. The two first are specially adapted for edgings, and may be used with the best result. The seed may be sown equally well in autumn or spring; sown in autumn, it produces stronger plants, whilst spring has the advantage of a longer duration, lasting till late in the autumn.



DELPHINIUM CONSOLIDA FLORE PLENO CANDELABRUM.

REVIEWS OF BOOKS.

Five Weeks in a Balloon: a Voyage of Exploration and Discovery in Central Africa. From the French of JULES VERNE. London: Chapman & Hall. 1870.

WHEN Edgar Allan Poe thought to satirize the ambitious ideas of the aëronauts of his time, he wrote his celebrated story of the adventures of one Hans Pfaell in his voyage to the moon. Poe graphically described the wonderful scheme of the little tobacco-loving Dutchman, and detailed the process by which his balloon was manufactured out of newspapers, and by what means its inflation was provided for. Further, he gave an account of the meteorological and other phenomena experienced by Hans on his lunar voyage; and, at last, he explained what the terrible consequence was of his coming within the sphere of the moon's attraction. The satire was a very perfect one, and the tale was told with only Poe's sense of humour.

The work entitled *Five Weeks in a Balloon* is evidently a work of the same type as that which Poe wrote; but we think it lacks much of the constructive cleverness so characteristic of that wonderful American genius. It is, we suppose, what would be called a skit on both æronauts and African travellers, and reminds us in some of its passages of Thackeray's well-known *Tremendous Adventures of Major Goliath O'Grady Geoghegan.* It recounts how a certain Dr. Fergusson, being determined to explore the centre of Africa, and having a wholesome horror of the sufferings of men like Livingstone, Speke, and others, contrived a gigantic balloon for the purpose of an aërial voyage over the African country. The several adventures of the brave doctor and his companions are then cleverly told; and their privations, attacks on the animals of the country, and hair-breadth escapes from the savages, &c., make an amusing story, clearly satirical on the travellers' tales which some of the present generation of explorers are wont to indulge in. The illustrations are clever and numerous.

Water Analysis: A Practical Treatise on the Examination of Potable Water. By J. ALFRED WANKLYN, M.R.C.S., late Professor of Chemistry to the London Institution; and ERNEST THEOPHRON CHAPMAN, Member of the Council of the Chemical Society. 2nd Edition, by E. T. Chapman. London: Trübner. 1870.

THIS work has, deservedly we think, passed through a second edition, for it is almost the only work of its kind available to the hygienist and chemist. The treatise is especially remarkable as setting forth the methods employed by the authors for the estimation of organic matter as compared with the elaborate process adopted by Dr. Frankland—Messrs. Chapman and Wanklyn especially commend the use of Nessler's test as a means of estimating the previous and subsequent ammonia in water.

The present edition differs from the former one in several respects, the chief of which are as follows:—Some remarks on the Tetration of waters, a modification of the process for the estimation of nitrates, a chapter on volatile organic matter present in water, a method of estimating minute traces of lead, and lastly, a chapter on the purification of water. The latter is useful, but it by no means deals with the question of ordinary domestic purification of water; and this we think a sin of omission on Mr. Chapman's part. We trust that the editor, in the next edition, will give the public some idea of the relative values of the innumerable filters which are now palmed off on the public, each one as the "only filter," &c., which effectually purifies. The subject is one of great importance, in a sanitary point of view.

Science for the People. By THOMAS TWINING, V.P.S.A. London: Goodman. 1870.

THOSE who have the pleasure of Mr. Twining's acquaintance—and we presume he is personally known to all who are trying to improve the condition of the working man—are aware how much he has devoted himself to the development of a scientific industrial education for the masses. His economic museum at Twickenham is a wonderful condensation of representative articles of commercial and industrial interest, machinery, and such like, and will well repay a visit. His latest effort in his favourite direction consists in a letter addressed to Lord Henry Lennox, as chairman of the Society of Arts, on the best methods of propagating scientific and practical knowledge among the working classes. Such is the work now before us. We differ so materially from the author on many of the points he discusses, that it would occupy too much of our space to go into the question in these pages. But in some matters we are quite agreed with him, and on these we would refer our readers to what Mr. Twining has to say on the subject of public educational collections. The chapter on this subject is full of sound sense, and displays a keen appreciation of the wants of the people and of the best means of conveying knowledge through the influence of museums. It is, too, the result of Mr. Twining's wide experience in the formation and development of his own excellent collection. *Tout entier*, this book is a good one.

The Moss Flora of Sussex. By C. P. SMITH. Published by the Brighton and Sussex Natural History Society. 1870.

VISITORS to Brighton and its neighbourhood, who may be endowed with bryological tastes, will find this list a very useful one. It is preceded by a general account of the structure of the group, which is, on the whole, well and clearly stated.

A Catalogue of British Neuroptera. Compiled by ROBERT MCLACHLAN, F.L.S., Sec. Ent. Soc. The Ephemerida by the Rev. A. E. EATON, B.A. Published by the Entomological Society of London. London: Longmans. 1870.

IF the catalogue of British insects which that enterprising body, the Entomological Society, propose to bring out, at all approaches in completeness the excellent list of Neuroptera now issued, Zoologists will have reason to be grateful. It is not a fauna, giving the distribution of the insects to which it refers; but is a list which, under the heading of the genus and species, gives an abbreviated reference to the various published accounts of the animal, whether in English or foreign periodicals. Its index is brief and well arranged.

Biology versus Theology. By JULIAN. Lewes: Bacon. 1870.

A CLEVER but too one-sided attack on Modern Theology and Christian doctrines generally. The author we presume to be an Atheist, for he makes no concealment whatever of his opinions. As we said, in noticing a former work by Julian, he reminds us of Louis Büchner.

Ice. A Lecture delivered before the Keswick Literary Society. To which is appended a Geological Dream on Skiddaw. By J. CLIFTON WARD, F.G.S. London: Trübner.

IT was from this interesting *brochure* that we extracted the paper entitled "A Geological Dream on Skiddaw," which some time ago appeared in our columns. We now call attention to it, lest our readers may imagine that they found the whole of the work in these pages. The lecture on "Ice" is worthy of attention.

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Etude sur les eaux de Baréges, pendant l'été de 1869. Par M. Féguex, Pharmacien major. Paris. Martinet.
Faune entomologique française Lépidoptères. Description de tous les papillons opii se trouve en France, indiquant l'époque de l'éclosion de chaque espèce, les localités quelle fréquente, la plante qui nourrit la chenille, le moment où il convient de la chasser. Par M. E. Berce, Ex-président de la Société entomologique de France. Paris. Deyrolle Fils.
Histoire naturelle des Poissons, ou Ichthyologie générale. Par. Aug. Duméril, Membre d l'Institut, Professeur administrateur au Muséum d'Histoire naturelle de Paris. Ouvrage accompagné de planches. T. 2, Ganoïdes, Dipués, Lophobranches. Paris. Roret.
Introduction à la physique Mathematique, de la Fonction potentielle. Par R. Clausius, Professeur à l'Université de Bonn. Traduit de l'Allemande. Par F. Folie, Professeur à l'École industrielle de Liége. Paris. Gauthier-Villars.
Les Merveilles de la Science, ou description populaire des Inventions modernes. Par Louis Figuier. 1,500 graveurs par les meilleurs Artistes. Paris. Jouvet et Cie.
L'Instinct et l'Intelligence des Animaux; Discours de réception prononcé dans la Séance publique, du 13 Juin, 1869, de l'Academie impérial des Sciences, Belles-lettres, et Arts de Marseille. Par M. Lespés, Professeur à la Faculté des Sciences, Marseille. Barlatier-Feissat, Père et Fils.
Luxation de l'Astragale sur le Scapholde, avec écrasement de sa face, postérieure et issue à travers la peau; extraction de l'Astragale Guérison. Par le Docteur Ad. Dusseris.
Sur les Accidents graves qui ont suivi la Vaccination, en 1869, de 130 Enfants des environs d'Auray; recueil de Documents lus, à l'Académie de Médicine ou publiés dans les Journaux pour répondre aux critiques adressées à la thèse du 9 Aout, 1869. Par E. Bourdais, Docteur en Médicine. Paris. Malteste et Cie.
Tétanos chronique. Par M. le Docteur Jouon, Professeur à l'École de Médecine. Nantes. V. Mellinet.

CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.
No notice whatever will be taken of anonymous communications.
We cannot undertake to return rejected communications.

New Living Corals.—*From* Mr. P. H. Gosse, F.R.S.

Sir,—I have little doubt that Mr. Kent is correct, and that I am wrong. I can only express my regret that I have unintentionally augmented the vast heap of synonyms, which are the scandal of our natural history.

Your obedient servant,

Torquay, June 2. P. H. Gosse.

A Plea for my First-born.—*From* Mr. R. A. Proctor, R.A., F.R.A.S.

"If there is nothing new—but that which is
Hath been before—how are our brains beguil'd,
Which, lab'ring for invention, bear amiss
The second burthen of a former child."
—*Shakespeare's Sonnets.*

Sir,—I always find much new matter in Scientific Opinion; for, indeed, you do not let the grass grow under your feet, like some I could name. But you have never stated anything more startlingly new—to me, at least—than when you describe me as "little more than the compiler" of *Saturn and its System*—

My *Saturn* a compilation!!

* * * *

After a pause, I read the rest of your review of my *Other Worlds*. Believe me, sir, your kind words of praise—not the first by which you have encouraged me to seek to merit your good opinion—were fully appreciated. Nor was I troubled that you should mistakenly suppose a chapter was intended to convince the sceptic which I did not even mean for his perusal. But——I could not forget my first-born. It jarred painfully on my feelings that my *Saturn*, which was the offspring of many long hours of toil, should have been spoken of as if it were that contemptible thing, a *compilation*.

I hope, sir, there is some excuse for an author who claims his own; that he will not be thought egotistical and opinionative if he declines to hand over to others what he has laboriously wrought out himself. If not, I fear I shall offend; for I venture to claim *Saturn* as my own, and *not* a compilation. I claim more. I assert that no astronomical work of its size has appeared during the past century in which the original matter has borne so large a proportion to that which may be spoken of as the common property of astronomers. There is not a statement in the book, unless distinctly referred to authority, which is not founded on my own calculations. There is not a plate in the book (except the pictures of Assyrian devices) of which every detail was not founded on my own calculations. There is not a table in the book which I did not calculate from beginning to end (save only, of course, parts of the tables of elements). Of seven chapters, the whole of I., II., IV., VI., and VII. are absolutely original from beginning to end. The chapter on Telescopic Discoveries necessarily contains accounts of the work of other people; and in the chapter on the Nature of the Rings I refer to Laplace, Maxwell, and others; but the larger portion even of these two chapters is altogether original.

In a review of *Saturn*, in the *Intellectual Observer* for August 1865 (the book is much less than ten years old—by the way, ten years ago I was at college), the complaint was made that "Mr. Proctor does not refer sufficiently to his authorities." My answer was and is, I *had no authorities*, save mathematics and calculation, for one single statement, between cover and cover, not distinctly referred to authority.

As I regard compilation as only another word for plagiarism, you will understand my seeking to save my first-born (and favourite), *Saturn*, from unmerited reproach.

You will say, perhaps, "I have seen in a popular small treatise on astronomy, passages which correspond, almost word for word, with some in *Saturn*; and also a woodcut identical with a part of a plate in *Saturn*, even in the minutest peculiarities; and as no reference is made to your being the author, it follows beyond question that you (Mr. Proctor) and the author of that work have compiled from a common authority." That that work *does* contain such passages is true; I wish it were equally true that, in our days, no author ever borrows without the courtesy of an acknowledgment.

I forward to you the note-book containing the bulk of my calculations about *Saturn*. Excuse its condition; but I think you will agree it affords tolerably clear evidence of original labour.

Yours very truly,

London, June 2. Richard A. Proctor.

P.S. I do not think it probable that anything Mr. Lockyer can urge would rehabilitate his theory of the corona. Sir J. Herschel long since disposed of it when he wrote that, so far as our atmosphere is concerned, "the sky ought to appear totally dark" round the sun in total eclipses." See his *Outlines of Astronomy*, § 395. *It is most important*, in view of the coming eclipse, and of the very brief duration of totality, that it should be known by observers that every moment given to this "atmospheric glare theory" (save the mark!) will be a complete and most mischievous waste of time; no one who has any knowledge of tridimensional mathematics will doubt this for a moment, *few* would even condescend to discuss the question. Of these few, in my wish to see science progress without needless delays, I am one.

[We have been induced by Mr. Proctor's letter to examine both his *Saturn* and his MS. note-book, and we are compelled to cry *Peccavimus!* His work is one undeserving of the epithet applied to it in our review, and based merely on our imperfect recollection. We can only add *Humanum est errare*, and beg that Mr. Proctor will accept our explanation, and make his absolution as plenary as our confession. —Reviewer of "Other Worlds than Our's."]

A Query, *re* Ursa Major.

Sir,—Perhaps one of your readers, who may happen to possess a telescope of sufficient power, would be kind enough to say what is the distance between the components of ξ1 Ursæ Majoris; the latest

accessible catalogues give 2·1″; but it must be much less than that now, for 4½ inches; power 150, only, slightly elongate it; and a power of 250 will not divide it, but only makes the elongation a little more obvious.

With many apologies for trespassing on your space, I am yours, &c.,

M. B. B.

DELIAPHILA LEVORNICA, AT BRIGHTON.—*From* MR. T. W. WONFOR.

SIR,—I have just seen, on the setting-board, a specimen of *Deliaphila Livornica*, taken in the immediate neighbourhood, on Tuesday, May 31st, by A. Gates, 51, Belgrave-street. The wings are slightly rubbed.

Yours faithfully,

Brighton, June 4. T. W. WONFOR.

UNDERGROUND TEMPERATURE.

SIR,—I enclose my notes of the temperature 2 ft. below surface for last and this year.

You will see May this year began 2° *below* last, and ends 3° *higher*.

In my last I referred to an earthquake on 18th March at St. John's, New Brunswick, North America, and the loss of a ship in the Channel the same day. I see an earthquake was felt in *Natal* on 18th March; again, the day the *Carnatic* was lost in the Red Sea, an earthquake was *noted* at Moulmein.

I see by SCIENTIFIC OPINION there is now a recognized connection between earthquakes and our atmospheric electricity.

Were these two ships lost by an earthquake affecting their compasses?

Temperature of the Earth at 2 ft. below surface.

1869.		1870.	
		May 1 and 2	47°
May 3	49°	3 to 7	46°
7	50°	8 to 13	47°
10	50°	14 to 17	48°
17	50°		
		18	49°
		19	50°
21	51°	20 to 25	51°
24	50°		
25	51°		
31	49°	26 to 31	52°

Havant, June 1. C. J. B.

RELATION BETWEEN FUNGI AND PECULIARITIES OF SOIL.

SIR,—In your paper of the 1st of this month (p. 495), in a report of the proceedings of the Brighton and Sussex Natural History Society, Mr. Wonfor is stated to have remarked that the curious fungus, *Helotium æruginotum*, is only found where the Hastings sands crop out. The plant is abundant in woods in this neighbourhood, and is not confined to the decaying wood of the oak, but also to be found on that of the ash.

We are here far from Hastings sands, being on the Carboniferous limestone series, with a clay subsoil; so that I believe it will be found that the development of this fungi is not owing to anything "peculiar in the chemical conditions of the soil" where it occurs.

I remain, sir, yours faithfully, W. C. TREVELYAN.

Wallington, Newcastle-on-Tyne, June 3.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ROYAL SOCIETY.

MAY 19TH (continued from SCIENTIFIC OPINION last week, p. 491).—"Spectroscopic Observations of the Sun.—No. VI. By J. Norman Lockyer.—The weather has lately been fine enough and the sun high enough, during my available observation-time, to enable me to resume work.

The crop of new facts is not very large, not so large as it would have been had I been working with a strip of the sun, say fifty miles or a hundred miles wide, instead of one considerably over a thousand—indeed, nearer two thousand in width; but in addition to the new facts obtained, I have very largely strengthened my former observations, so that the many hours I have spent in watching phenomena, now perfectly familiar to me, have not been absolutely lost.

The negative results which Dr. Frankland and myself have obtained in our laboratory-work in the matter of the yellow bright line, near D, in the spectrum of the Chromosphere being a hydrogen line, led me to make a special series of observations on that line, with a view of differentiating it, if possible, from the line C.

It had been remarked, some time ago, by Professor Zollner, that the yellow line was often less high in a prominence than the C line; this, however, is no evidence (bearing in mind our results with regard to magnesium). The proofs I have now to lay before the Royal Society are of a different order, and are, I take it, conclusive:—

1. With a tangential slit I have seen the yellow line bright below the Chromosphere, while the C line has been dark. The two lines being in the same field of view.

2. In the case of a bright prominence over a spot on *the disk*, the C and F lines have been seen bright, while the yellow line has been invisible.

3. In a high-pressure injection of hydrogen, the motion indicated by change of wave-length has been *less* in the case of the yellow line than in the case of C and F.

4. In a similar quiescent injection the pressure indicated has been less.

5. In one case the C line was seen long and unbroken, while the yellow line was equally long, but *broken*.

The circumstance that this line is so rarely seen dark upon the sun makes me suspect a connection between it and the line at 5015 Angström, which is also a bright line, and often is seen bright in the Chromosphere, and then higher than the sodium and magnesium lines, when they are visible at the same time; and the question arises, must we not attribute these lines to a substance which exists at a higher temperature than those mixed with it, and to one of very great levity? for its absorption-line remains invisible, as a rule, in spot-spectra.

I have been able to make a series of observations on the fine spot which was visible when I commenced them on the 10th inst., not far from the centre of its path over the disk. At this time, the spot, as I judged by the almost entire absence of indications of general absorption in the penumbral regions, was shallow, and this has happened to many of the spots seen lately. A few hours' observation showed that it was getting deeper apparently, and that the umbræ were enlarging and increasing in number, as if a general down-sinking were taking place; but clouds came over, and the observations were interrupted.

By the next day (April 11) the spot had certainly developed, and now there was a magnificently bright prominence, completely over the darkest mass of umbra, the prominence being fed from the penumbra or very close to it, a fact indicated by greater brilliancy than in the bright C and F lines.

April 12. The prominence was persistent.

April 15. Spot nearing the limb, prominence still persistent over spot. At eleven I saw no prominence of importance on the limb, but about an hour afterwards I was absolutely startled by a prominence not, I think, depending upon the spot I have referred to, but certainly near it, more than 2′ high, showing a tremendous motion towards the eye. There were light clouds, which reflected to me the solar spectrum, and I therefore saw the black C line at the same time. The prominence C line (on which changes of wave-length are not so well visible as in the F line) was only coincident with the absorption-line for a few seconds of arc!

Ten minutes afterwards the thickness of the line towards the right was all the indication of motion I got. In another ten minutes the bright and dark lines were coincident.

And shortly afterwards what motion there was was towards the red!

I pointed out to the Royal Society, now more than a year ago,[1] that the largest prominences, *as seen at any one time*, are not necessarily those in which either the intensest action or the most rapid change is going on. From the observations made on this and the following day, I think that we may divide prominences into two classes:—

1. Those in which great action is going on, lower vapours being injected; in the majority of cases these are not high, they last only a short time—are throbs, and are oft renewed, and are not seen so frequently near the sun's poles as near the equator. They often accompany spots, but are not limited to them. These are the intensely bright prominences of the American photographs.

2. Those which are perfectly tranquil, so far as wave-length evidence goes. They are often high, are persistent, and not very bright. These do not, as a rule, accompany spots. These are the "radiance" and dull prominences shown in the American photographs.

I now return to my observations of the spot. On the 16th the last of the many umbræ was close to the limb, and the most violent action was indicated occasionally. I was working with the C line, and certainly never saw such rapid changes of wave-length before. The motion was chiefly horizontal, or nearly so, and this was probably the reason why, in spite of the great action, the prominences, three or four of which were shut out, never rose very high.

I append some drawings, made, at my request, by an artist, Mr.

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[1] *Proc. Roy. Soc.* 1869, p. 354, Mar. 17.

Holiday, who happened to be with me, and who had never seen my instrument or the solar spectrum widely dispersed before. I attach great importance to them, as they are the untrained observations of a keen judge of form.

The appearances were at times extraordinary and new to me. The hydrogen shot out rapidly, scintillating as it went, and suddenly here and there the bright line, broad and badly defined, would be pierced, as it were, by a line of intensely brilliant light parallel to the length of the spectrum, and at times the whole prominence spectrum was built up of bright lines so arranged, *indicating that the prominence itself was built up of single discharges*, shot out from the region near the limb with a velocity sometimes amounting to 100 miles a second. After this had gone on for a time, the prominence mounted, and the cyclonic motion became evident; for away from the sun, as shown in my sketch, the separate masses were travelling away from the eye; then gradually a background of less luminous hydrogen was formed, moving with various velocities, and on this background the separate "bombs" appeared (I was working with a vertical spectrum) like exquisitely jewelled ear-rings.

It soon became evident that the region of the Chromosphere just behind that in which the prominence arose, was being *driven back* with a velocity something like 20 miles a second, the back-rush being so local that, with the small image I am unfortunately compelled to use, both the moving and rigid portions were included in the thickness of the slit. I saw the two absorption-lines overlap.

These observations were of great importance to me; for the rapid action enabled me to put together several phenomena I was perfectly familiar with separately, and see their connected meaning.

They may be summarized as follows, and it will be seen that they teach us much concerning the nature of prominences. When the air is perfectly tranquil in the neighbourhood of a large spot, or, indeed, generally in any part of the disk, we see absorption-lines running along the whole length of the spectrum, crossing the Frauenhofer lines, and they vary in depth of shade and breadth according as we have pore, corrugation, or spot under the corresponding part of the slit—a pore, in fact, is a spot. Here and there, where the spectrum is brightest (where a bright point of facula is under the slit) we suddenly see this appearance—an interesting bright lozenge of light. This I take to be due to bright hydrogen at a greater pressure than ordinary, and this then is the reason of the intensely bright points seen in ranges of faculæ observed near the limb.

The appearance of this lozenge in the spectroscope, which indicates a diminution of pressure round its central portion, is the signal for some, and often all, of the following phenomena:—

1. A thinning and strange variations in the visibility and thickness of the hydrogen absorption-line under observation.
2. The appearance of other lozenges in the same locality.
3. The more or less decided formation of a bright prominence on the disk.
4. If near the limb, this prominence may extend beyond it, and its motion-form will then become more easy of observation. In such cases the motion is cyclonic in the majority of cases, and generally very rapid, and—another feature of a solar storm—the photospheric vapours are torn up with the intensely bright hydrogen, *the number of bright lines visible determining the depth from which the vapours are torn*, and varying almost directly with the amount of motion indicated.

Here, then, we have, I think, the chain that connects the prominences with the brighter points of the faculæ.

These lozenge-shaped appearances, which were observed close to the spot on the 16th, were accompanied by the "throbs" of the eruption, to which I have before referred; while Mr. Holiday was with me—a space of two hours—there were two outbursts, separated by a state of almost rest, and each outburst consisting of a series of discharges, as I have shown. I subsequently witnessed a third outburst. The phenomena observed on all three were the same in kind.

On this day I was so anxious to watch the various motion-forms of the hydrogen-lines, that I did not use the tangential slit. This I did the next day (the 17th of April) in the same region, when similar eruptions were visible, though the spot was no longer visible.

Judge of my surprise and delight, when, upon sweeping along the spectrum, I found HUNDREDS of the Frauenhofer lines beautifully bright at the base of the prominence!!!

The complication of the Chromosphere spectrum was greatest in the regions more refrangible than C, from E to long past *b* and near F, and high-pressure iron vapour was one of the chief causes of the phenomenon.

I have before stated to the Royal Society that I have seen the Chromosphere full of lines; but the fulness then was as emptiness compared with the observation to which I now refer.

A more convincing proof of the theory of the solar constitution, put forward by Dr. Frankland and myself, could scarcely have been furnished. This observation not only endorses all my former work in this direction, but it tends to show the shallowness of the region on which many of the more important solar phenomena take place, as well as its exact locality.

The appearance of the F line, with a tangential slit at the base of the prominence, included two of the lozenge-shaped brilliant spots to which I have before referred; they were more elongated than usual—an effect of pressure, I hold, greater pressure and therefore greater complication of the Chromosphere spectrum; this complication is almost impossible of observation on the disk.

It is noteworthy that in another prominence, on the same side of the sun, although the action was great, the erupted materials were simple, *i. e.* only sodium and magnesium, and that a moderate alteration of wave-length in these vapours was obvious.

Besides these observations on the 17th, I also availed myself of the pureness of the air to telescopically examine the two spots on the disk, which the spectroscope reported tranquil as to up and down rushes. I saw every cloud-dome in their neighbourhood perfectly, and I saw these domes drawn out, by horizontal currents doubtless, in the penumbræ, while on the floors of the spots, here and there, were similar single cloud-masses, the distribution of which varied from time to time, the spectrum of these masses resembling that of their fellows on the general surface of the sun.

I have before stated that the region of a spot comprised by the penumbra appears to be shallower in the spots I have observed lately (we are now near the maximum period of sun spots); I have further to remark that I have evidence that the Chromosphere is also shallower than it was in 1868.

I am now making special observations on these two points, as I consider that many important conclusions may be drawn from them. Another paper was one of great length by Professor Parkes and Count Cyprien Wollowicz, on the effects of alcohol on the human body; but this we shall probably reproduce in full among our articles in an early number.

GEOLOGICAL SOCIETY.

MAY 25TH.—Joseph Prestwich, Esq., F.R.S., president, in the chair. George Cox Bompas, Esq., 15, Stanley-gardens, Kensington Park, W.; Sir James Anderson, 16, Warrington-crescent, London; and John Breedon Everard, Esq., 6, Millstone-lane, Leicester, were elected Fellows of the Society.

The following communications were read:—

1. "Contributions to a knowledge of the Newer Tertiaries of Suffolk and their Fauna." By E. Ray Lankester, Esq., B.A. Communicated by Professor Huxley.

1. *The Suffolk Bone-bed and the Norfolk Stone-bed.*—The author pointed out that the recognition of the distinction of these two deposits from the overlying shelly crags was an important step in the determination of the history of these beds. He combated the notion that the Bone-bed and Stone-bed were identical in their contents; and especially dwelt on the differences of the mammalian fauna found in the two. The late Dr. Falconer's views, hitherto prevalent, consisting in regarding the fauna of the Suffolk Bone-bed, Norfolk Stone-bed, and Forest-bed as all of one and the same history and extent, he most strongly opposed. *Rhinoceros Schleiermachieri*, *Tapirus priscus*, Hipparion, *Hyæna antiqua*, and a well-defined Miocene Mastodon (Fauna 1), had been found in the Bone-bed below the Suffolk Crag; the first three in some abundance, but never in the Stone-bed or Forest-bed of Norfolk. They belonged to a different fauna from that indicated by the other mammals common to the Bone-bed and Stone-bed (Fauna 2), viz. *Mastodon arvernensis*, Equus sp., and certain forms of Cervus (studied by Mr. Boyd Dawkins). On the other hand, the *Elephas meridionalis* (Fauna 3), occurring in the Norfolk Stone-bed and in the Forest-bed, had *never* been found in the Suffolk Bone-bed. Mr. Lankester suggested that the association of the first two of these three groups of mammals in Suffolk, and of the second two in Norfolk, might be explained by the hypothesis that they succeeded one another in time, the first (late Miocene) being confined to Suffolk, and dating from before the Diestien period, since he had obtained a Mastodon tooth of the *M. tapiroides* form enclosed in a Diestien box-stone, the third having existed in Norfolk at a period subsequent to the Coralline Crag, but before the Norwich Crag was deposited, chiefly represented in the lower part of the Forest-bed, but also in the Stone-bed, whilst the second group of mammals had existed in both areas at an intermediate period. Mr. Lankester maintained that this was the explanation suited to the facts as they at present stand, and considered that the question was not one to be shirked. All geological inferences from palæontology rest on what is called negative evidence, and hypotheses must be used in investigation. It was shown that the London clay had contributed very little indeed to the lot of mammalian remains found in the Suffolk Bone-bed. Six teeth of Coryphodon and four fragments of Hyracotherium were all that could be found in the various collections.

2. *The Suffolk Box-stones.*—These nodules the author had previously described as being the remains of a deposit approximately similar to the Diestien or Black Crag of Antwerp, which had preceded the Coralline Crag in Suffolk. An enlarged list of remains of Mollusca from these nodules was given, and a large series of specimens collected by

the author was presented to the Society's Museum. It was from the Diestien beds, containing *Conus Dujardinii*, *Voluta auris-leporis*, *Isocardia lunulata*, &c., that the Cetacean remains of the Suffolk Bone-bed were derived.

3. *A new Ziphioid Cetacean from the Bone-bed of Suffolk.*—The rostrum described in detail was in the collection of the Ipswich Museum. It indicated a Cetacean of the genus Choneziphius, differing from *C. planirostris* of Cuvier and *C. Cuvieri* (of Prof. Owen's Monograph), in having a solid projecting apex to the rostrum, and no trace of a bifid structure. Mr. Lankester had recently carefully examined Cuvier's original specimens in Paris, and suggested that possibly *Choneziphius planirostris*, *C. Cuvieri*, this and two other Antwerp specimens are but varieties of one species, according to age and sex. This form was, however, noted as *Choneziphius Packardi*.

4. *A new Mastodon from the Suffolk Bone-bed.*—A Mastodon tooth, enclosed in Diestien matrix, and indicating a form with open and clear valleys, had been obtained by Mr. Baker, of Woodbridge, and noticed by the author a year ago. He had since, in various collections, detected eight other fragments of a Mastodon, very distinct from *M. arvernensis*, and approaching *M. tapiroides*. Possibly the fragments indicated more than one such distinct species. The condition of these specimens and other evidence tended to associate them with the *Rhinoceros Schleiermacheri*, Hipparion, &c., forming a fauna quite distinct from and older than that which was indicated by *Mastodon arvernensis*.

5. *List of Mammalian Fossils of the Suffolk Bone-bed, with reference to Collections containing them, and Number of Specimens.*—The object of this list was to furnish an idea of the actual and relative abundance of the various mammalia, and to afford those interested in the matter information as to the much scattered materials in private collections.

Discussion.—Mr. Boyd Dawkins had arrived at a different conclusion from the author, though the discoveries recorded in works on palæontology showed a marked difference between the Suffolk and Norfolk Crag-faunas, such as was not borne out by an examination of collections. He considered that the forms of Ruminants showed a contemporaneity between them. The supposed *Cervus dicranoceros* of Owen was, in fact, another form of deer, which was common to the base of both the Suffolk and Norfolk crags. The *Elephas meridionalis* and *Mastodon arvernensis* had been found side by side in Norfolk, at Ecclesham, and in the Val d'Arno, and were therefore probably contemporary. The different lithological character in the two counties was probably due to the different nature of the underlying beds.

Sir Charles Lyell was much struck with the perfect identity between the boxstones of Suffolk and some exceptional Antwerp beds which he had seen at Berchem, and considered that this was sufficient to prove they belonged to the same deposit. He thought that the area between Belgium and England might have contained a large number of terrestrial beds, which eventually left a certain number of their contents to be mingled together in the lower beds of the later marine deposits.

The Rev. J. Gunn produced, from the Norwich Crag at Waldingfield, a portion of the tooth of *Elephas meridionalis*. He insisted on the complex nature of the forest-beds, which consisted of two parts, the lower, estuarine, containing *E. meridionalis* and deer, and the upper, terrestrial, with remains of *E. antiquus*, and, more rarely, *E. primigenius*.

Prof. Ramsay pointed out the necessity of there being a great intermixture of remains of various characters and ages in such deposits as the Crag. If, for instance, the Auvergne, which had not been submerged since Eocene times, were now depressed below the sea, future geologists might find the remains of Eocene animals intermingled with those of the present day.

Mr. Ray Lankester, in reply, contended that the Miocene forms of *Hipparion Rhinoceros Schleiermacheri*, the trilophodont Mastodon, and other Miocene animals, had been found in the Norfolk beds; while *Elephas antiquus* had not been found in those of Suffolk. The specimen brought by Mr. Gunn was decidedly not from the Suffolk Bone-bed, but from overlying beds.

2. "Notes on an Ancient Boulder-clay of Natal." By Dr. Sutherland, Surveyor-General of the Colony. Communicated by Prof. Ramsay, F.R.S., F.G.S.—The author described the extensive occurrence in Natal of a formation which he considered to present the essential characters of Mr. Bain's "claystone porphyry." It consisted of a greyish-blue argillaceous matrix, containing fragments of Granite, Gneiss, Greenstone, Clayslate, &c., often of large size, exhibited ripple-markings in some places, and in others showed a rude approach to wavy stratification. It rested generally upon Old Silurian Sandstones, the upper surface of which was often deeply grooved and striated. The author regarded this deposit as an ancient Boulder-clay, perhaps of the Permian age.

Discussion.—Dr. Mann called attention to some specimens which he had brought in illustration of Dr. Sutherland's paper, which showed the gradual transition from a state closely resembling that of an igneous rock into that of a truly stratified deposit.

Mr. T. M'K. Hughes, while admitting the probability of a recurrence of Glacial periods, disputed the evidence in this particular case. The shape of the stones, the admixture of different rocks and of angular and subangular fragments, might be accounted for in a different manner than by glacial action. The streaking of the rocks below might be due to pressure, while the ripple-marks and lamination were certainly not glacial. The structure also might be due to faulting of the beds rather than to transport by ice. He argued, that if any of the Permian beds of the North of England had been deposited by the intervention of glaciers, they would more particularly present the characteristic features when deposited in troughs or valleys; whereas this was not the case. He therefore thought that the whole question required further evidence.

Prof. Ramsay combated the views of Mr. Hughes, and maintained that there was no necessity for supposing that all the pre-Carboniferous rocks were above water at the time of the deposit of the Permian beds of the north of England. Still he had never maintained that any of those deposits were due to glacial action, but only more southern beds. He pointed out that in the Natal beds under discussion enormous blocks of rock occurred, which were 60 or 80 miles from their original home, and still remained angular; and there was a difficulty in accounting for the phenomena on any other hypothesis than that suggested. He still maintained the probability of the occurrence of glacial episodes, not only in the Permian but in other ages, as he had done now fifteen years ago. A Boulder-clay might be recognized, not only by the striæ on the stones, which were not always present, but by the general character of the agglomeration of the beds.

3. "On the Distribution of Wastdale Crag Blocks, or 'Shapfell Granite Boulders,' in Westmoreland." By Prof. Robert Harkness, F.R.S., F.G.S.—The author described the position of Wastdale Crag and the general distribution of the blocks of granite derived from it, and discussed the hypotheses which have been proposed to account for this distribution, and especially to explain how the blocks could have been transported to the eastern side of the elevated ground of Stainmoor. The author considered that neither of the extant hypotheses, accounting for the transport of these blocks by the agency of a glacier or of icebergs, was tenable; and he indicated what he regarded as the chief objections to each of them. He suggested that their transport had been effected by the agency of coast-ice, the land being depressed to the extent of about 1,500 feet, which would leave the Wastdale Crag sufficiently exposed to atmospheric action to enable it to furnish the blocks; the icefloes, serving as rafts, would suffice to convey the blocks to other parts of the coast, whilst they would not require any great depth of water to float them.

Discussion.—Mr. Hughes pointed out some difficulties in accepting the theory of the transport of these blocks by means of coast-ice, but was not able to offer any better solution of the question than that suggested by the author.

The following specimens were exhibited:—Fossils from the Suffolk Tertiaries; exhibited by E. Ray Lankester, Esq., in illustration of his paper. Specimens illustrating the Claystone Porphyry Series of Natal, referred to in Dr. Sutherland's paper; exhibited by Dr. Mann. Flint Implements from Hampshire; exhibited by John Evans, Esq., F.R.S., F.G.S. Specimens from the Stonesfield Slate; exhibited by Prof. Tennant, F.G.S. Specimen of Zinc-blende, showing water-cavities; exhibited by H. Bauerman, Esq., F.G.S.

ZOOLOGICAL SOCIETY.

May 26th.—G. R. Waterhouse, Esq., vice-president in the chair.—A letter was read from Mr. W. H. Hudson, C.M.Z.S., containing remarks on birds observed in and around Buenos Ayres, being the fourth communication received from this gentleman on the same subject.

Mr. R. B. Sharpe exhibited and made remarks on a specimen of a rare Asiatic bird *Podoces panderi*, from the collection of Lord Lilford.

Professor Owen read the sixteenth of a series of Memoirs on *Dinornis*, containing an account of the trachea and of some other internal organs of certain species of this genus, together with a description of the brain and some nerves and muscles of the head of *Apteryx australis*.

Dr. J. Murie read a paper on the anatomy of the Prongbuck (*Antilocapra Americana*), founded on the examination of the specimen of this animal which had died in the Society's Gardens in the year 1867.

A communication was read from Dr. A. B. Meyer, containing remarks on the poisonous glands of the snakes of the genus *Callophis*, being supplementary to his paper on the same subject published in the *Monatsberichte* of the Academy of Berlin.

A communication was read from Surgeon Francis Day, F.Z.S., containing notes on some fishes from the Western Coast of India, amongst which were several species described as new to science.

Mr. H. Adams communicated the descriptions of some new species of Land and Fresh-water Shells obtained by Mr. E. Bartlett, in Eastern Peru, and by Mr. R. Swinhoe in China and Formosa. Mr. Adams also described two new species of Land Shells from Africa.

ETHNOLOGICAL SOCIETY.

SPECIAL SECTIONAL MEETING, JUNE 1ST.—Professor Huxley, president, in the chair. Colonel Lane Fox read communications from Dr. Caulfield on the discovery of copper celts near Bruttivant, Co. Cork; and on a supposed Ogham inscription from Rus-glass, Co. Cork.

Mr. C. Spence Bate, F.R.S., presented an elaborate "Report on the Prehistoric Antiquities of Dartmoor," forming one of the series of reports being now collected by the Society, with a view to obtaining accurate information on the present condition of the megalithic monuments of this country. After noticing the physical features of the district, the author described in detail the numerous stone circles, avenues, menhirs, cromlechs, cavins, and other prehistoric monuments of Dartmoor. He suggested the idea that the stones in some of the avenues may have been erected in commemoration of the death of persons of distinction—one being added for each burial. The depressions on the summit of some of the cairns were regarded rather as indications of unfinished work than of subsequent disturbance by treasure-seekers. Evidence was adduced of the wanton destruction of the granite-blocks in some of the cromlechs; and, both in the paper and in the subsequent discussion, attention was forcibly directed to the importance of extending legislative protection to these prehistoric monuments.

The discussion was sustained by Mr. W. Morrison, M.P., Mr. Moggridge, Mr. Hyde Clarke, Mr. Black, Rev. G. Saint-Clair, Dr. Campbell, and Mr. Lewis.

ANTHROPOLOGICAL SOCIETY OF LONDON.

MAY 31ST.—Dr. R. S. Charnock, V.P., in the chair. George Thorne Ricketts, H.M. Consul, Manila, was elected a fellow.

A paper by Dr. John Shortt was read on "the Armenians of Southern India." Early in the sixteenth century a few Armenians found their way into Southern India, with the countenance and support of the Hon. East-India Company; and under a contract with the company, equal privileges with British subjects were conceded to the Armenians. The company further extended favours to them when they reached, in any town, the number of forty, by the provision of a place of worship and by annual grants of money. For a long time after their arrival in India they avoided mingling with other people, but latterly that rule has been broken through, and alliances in marriage with Europeans are not unfrequent. The Armenians have diminished in numbers; and, it is said, are daily decreasing in influence. The chief causes of their approaching extinction in India appear to be the vice of intemperance, the taint of disease, and the contact with the Europeans, more especially the English. The physical and moral characteristics were described; in the former it was stated that the Armenians are strongly allied to the Jewish race, from which they claim descent.

A paper by Mr. John Stirling, M.A., was read, "On the Races of Morocco." The inhabitants of that part of Barbary known as Morocco may be arranged under the following heads—viz., Berbers, Al-*Ryf*, Arabs, Bohára troops, and other negroes or half breeds, and Jews. The word Kabyles, often erroneously used to designate some North African race, is a term applied by the Moors to distinguish villagers or country people engaged in agriculture. The Berbers are probably of Phœnician blood, mixed with an old race indigenous to Morocco; at any rate, the remains of dolmens and other monuments would point to that origin. The Al-Ryf are wild descendants of the Ryf pirates, the inhabitants of the northern spurs of the Atlas range which separates Morocco from Algeria. The Al-Ryf are comparatively a fair people, and such of them as follow in-door occupations exhibit a delicate olive complexion.. The Bohára troop form a remarkable race; their ancestors were a rebellious Negro tribe living south of the Atlas. They have married with Moorish women, but still retain to a great degree the Negro aspect. The Negroes of Morocco have intermarried with the fair Moors, and produced a mixed race. The true Moors are fair, some individuals having blue eyes and light or red hair.

Sir Duncan Gibb, Bart., M.D., in a paper "On the Paucity of Aboriginal Monuments in Canada," attributed the absence in Canada of monuments built of stone to the peculiar character of the climate, which would be unfavourable to their preservation. He anticipated the discovery some day of traces of the ancient inhabitants in the great caverns north of Flamborough, and in the island of Anticosti.

At the next meeting, June 14, Dr. Beddoe, president, will read a paper on the "Kelts of Ireland." Papers will also be contributed by Dr. Henry Hudson on the "Irish Celt," and by Mr. G. H. Kinahan on "The Race Elements of the Irish People."

ROYAL INSTITUTION OF GREAT BRITAIN.

MONDAY, JUNE 6.—General monthly meeting, Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., president, in the chair. Miss Conway Griffiths; Hugh Martin Macpherson, Esq., F.R.C.S.; William O. Priestley, M.D., F.R.C.P.; Henry Sutherland, Esq., M.B., were elected members of the Royal Institution. The special thanks of the members were returned for the following donations to the "Fund for the Promotion of Experimental Researches":—T. William Helps, Esq. (5th donation), £10; Erasmus A. Darwin, Esq. (2nd donation), £25; Sir Henry Holland, Bart., M.D. (12th annual donation), £40. The presents received since the last meeting were laid on the table, and the thanks of the members returned for the same.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

MICROSCOPICAL SECTION, MAY 26th.—The president, Mr. T. H. Hennah, F.R.M.S., in the chair. Present among the visitors, Drs. Addison, Kebbell, and Mr. Peake, members of the Brighton Microscopical Club.

As this was the first meeting of the section, Mr. Wonfor, hon. sec., briefly stated the reasons for forming the sections, and the objects sought to be done by its members; and announced the receipt of 18 slides from the president, 6 from Dr. Hallifax, and 38 from himself, for the Society's cabinet.

The president then delivered an inaugural address on "Systematic *Recent* Examinations, with Moderate Powers":—As a suggestive subject for consideration at the first meeting of our Section, I have to ask your attention to a few notes on Microscopical Examination, in its application to our objects as members of the Natural History Society. The limited time at our disposal obliges a rather special view; and I propose to take as my text, "Systematic *Recent* Examinations, with Moderate Powers;" believing that, whether we regard the extension of our knowledge of Natural History, the success of this Section, or our own pleasure in microscopic study, it is alike indispensable. Most of the discoveries with the microscope have been made with instruments of moderate power and cost, and have resulted from patient, diligent observation. As we glance through the history of the microscope, we cannot avoid noticing how little has depended upon the instruments, and how much upon the method and perseverance of the men who have accumulated so vast an amount of information; and, although the wonderful perfection of modern high powers,—and, indeed, of the microscope generally,—has undoubtedly increased both our means of research and the number of observers, the conclusion is forced upon us that—as we use it—the microscope is almost a new sense, or a mere toy. I hope the growing tendency to the latter result may find no place amongst us. Pride in the possession of a fine instrument, and a consequent desire to exhibit its powers, often leads to the exclusive study of conventional test objects; which, while it gives command of the microscope in a special way, and stimulates opticians to improvements, too frequently arrests original investigation. The ordinary work of the naturalist can, in the first instance, be better pursued with low than with high powers. Extreme nicety of preparation and elaborate illumination are not required with them, while the excellence of modern halfs and fifths is so great that appeals to higher powers are only occasionally needed. I would not at the same time underrate the importance of having a reserve of power, as some investigations cannot be carried on, except under the highest possible amplification. I wish simply to enter a protest against the loss of time involved in the employment of unsuitable means. Whether we use high or low powers, we should—in original investigations—be on our guard against the unconscious tendency of the mind to "make the wish father to the thought;" and, although we cannot be altogether free from preconceived ideas, their influence should be limited to the *suggestion of inquiry*. It is necessary for a just appreciation of our own work (and that of others) that we should be well acquainted with the literature of the microscope. It is, however, already so much scattered that it is difficult to ascertain the actual amount of knowlege on any given subject, and much time is wasted in investigations which should be but past steps in our progress. At the same time, we should not too readily accept authority on matters difficult of proof, as a false idea of the state of microscopical knowledge is frequently given, and doubt arises as to our powers of observation or the instruments we are using. I may instance the structure of some of the diatom valves, which, although demonstrated nearly fifteen years ago, was, in consequence of the erroneous views of Griffiths, Wallich, and others, held still to be an open question until only last year, the President of the Royal Microscopical Society announcing *his* demonstration of their structure as a "new birth to the microscope." In making these remarks, I wish to acknowledge fully the obligations we are under to men who have laboured so earnestly to our advantage; and in calling attention to exceptional error, I am but endeavouring to provoke careful, original investigation amongst us in place of idle reliance on any authority. In the frequent intercourse of men engaged in a common pursuit—such as it is the intention of this Section to promote—lies the best substitute for individual experience; the knowledge acquired by any should be available for all, and errors of solitary observation are soon corrected when brought to the test of criticism and comparison. Most conducive to a true knowledge of objects is

their examination in a recent state, and an acquaintance with the appearance of ordinary things will be found much more valuable than than the settlement of a *diatom* or *podura* question. In the food we eat, the clothes we wear, the parasites that plague us, and the very dust about us, there is a large field for investigation as a necessary preparation for other studies, which has also an interest of its own, in a time when the President of the Board of Trade tells us that adulteration is but a form of trade competition. The poor Welsh impostor gave evidence of her fatal deception only a short time since, in the starch which the microscope discovered in her stomach; and many other instances might be adduced to recommend the study of common things. Our principal object, however, should be to inquire into the natural history of our own locality, the minute fauna of which has been but imperfectly examined. Our shore offers every inducement to extend research. The smaller Crustaceans are scarcely known amongst us, although two of the most curious and interesting—the Caprella and Ammothea—abound on the weed at Kemp Town, and give promise of allied species of greater rarities as a reward for search. Acorn barnacles and shore crabs are instances of strange metamorphosis, as are also the polyps, of which *laomeda obliqua* and Geniculata abound. The urn-shaped egg-cases of *Purpura lapillis* and the ribband-like strap of eggs of *Doris tuberculata* can generally be found to illustrate the extraordinary embryonic development of the mollusca; there is, in fact, scarcely a limit to the list of subjects waiting for examination. For full appreciation of minute structure, comparison with permanent specimens is both necessary and interesting. They cannot, however, be seen under sufficiently varied conditions; and we may as well take an ancient Egyptian as a specimen man, as trust exclusively to the mummies in balsam which fill our cabinets; we must, instead,—as students of Nature,—follow her home, and watch her ways patiently, as far as we can. Nothing can be known of the protozoa, or rotatoria, unless we examine them in life. Cyclosis in vegetable cells must in like manner be seen in life to be seen at all. The generation of the cryptogams would be really hidden if the germination of their spores had not been a subject of unwearied attention. The structure of the Foraminifera was not demonstrated by Carpenter without systematic work. The discovery of the alternation of generations was due to careful study, and the knowledge of the fact of the Polyps of our shores having other existences as free swimming Medusæ considerably modified our previous ideas respecting them. The well-known sections of insects, by Dr. Hallifax, show the viscera and nervous system undisturbed, and—better still—the advantage to others, as well as ourselves, of well-directed work. As a concluding illustration, I may mention that the stupendous tale of past life, read by the microscope in our chalk cliffs, would have been incomplete without that systematic comparison with the bottom of the present ocean, which has proved the persistence through ages, not only of the laws of Nature, but of the forms of life. I have not chosen Pathological examples, notwithstanding the pre-eminent importance of microscopic examination in Pathology, as its study is scarcely within our province. I hope, however, that I have sufficiently supported my opening statement of the advantage of systematic work, in place of such desultory observations as are comparatively worthless. Our interest must increase with well-directed study; and numberless facts which we at first pass by, unnoticed, may eventually teach lessons of lasting use. The prism had shown the spectrum to thousands before Newton's intellect gave its interpretation; and, although the comparison may seem far-fetched, there are subjects within range of the microscope which, by the exercise of thought and reason, may still further demonstrate the connection of the infinitely great and the infinitely little, and assist us to know more of the life which it has already taught begins in a germ—apparently the same, whether it results in the highest or lowest of organized beings. We can all make some advance to such knowledge by the systematic study of recent things, which I have endeavoured to recommend, even by tedious repetition; and I trust that by our work we may justify the formation of this Section of our Society.

The meeting then resolved itself into a conversazione, at which a number of very interesting microscopic objects were exhibited by the following gentlemen:—Mr. J. Dennant exhibited sections of fossil teeth from the coal-measures. Dr. Hallifax showed some of his sections of insects, in which the internal parts were displayed *in situ*, one of the most striking being the lady-bird. Mr. Aylen showed a number of entomological preparations. Mr. Cooper exhibited deep sea soundings from different localities, and Foraminiferæ from Hastings, the Mediterranean, and Australia. Mr. Sewell exhibited injected preparations of Dr. Thudichum's rabbit, an animal possessing a world-wide reputation, from being fed at times on muscle containing *Trichina spiralis;* the presence of entozoa was traced in all parts of the voluntary muscle, but nowhere else. Dr. Addison exhibited blood, as acted upon directly by various agents, such as diluted sherry, &c.; the effect produced was an alteration in the appearance of the blood disks, and, as some expressed it, the formation of tails; this was considered by no means the least interesting part of the evening's display. Dr. Kebbell exhibited with a Nachet's prism the rasping teeth situated on the disk of the proboscis of the blow-fly. Mr. Smith showed fruit of Hepaticæ and Epicarmal stomata of moss, *funaria*. These are only found on the fruit of mosses, and never on the leaves. Mr. Hennah showed plant circulation in the hairs of the *Tradescantia*, spider-wort, and remarked that every microscopist should possess a root of this plant in his garden, pollen showing the production of the pollen-tubes, caprellæ from Black Rock, Kemp Town, *Tubularia*, illustrating the Polyps and *Micrasterias*, with endochrome perfect, and mounted, living in 1865, in the water in which they were gathered. Mr. Peake exhibited the *pygidium* of the lace-wing fly, *chrysopa perla*, discovered by himself. The existence of this peculiar structure has long been known in the flea, but has not been pointed out in any other insect. Mr. Wonfor exhibited a slide of Diatoms, mounted by Müller, of Holstein; on which, in the space of a quarter of an inch, 408 separate siliceous skeletons of plants were arranged in symmetrical rows. This slide, which was a marvel of skill in microscopic mounting, arrangement, and perfection of specimens, was kindly lent for the occasion by Mr. T. Curteis, of Holborn. It was to the student of this department, not simply a wonderful slide, but a cabinet of objects; in fact, a printed catalogue lay by the side of the microscope for reference to any particular valve; live caterpillars of the emperor moth, very gorgeous crystals of *hematoxylyn*, the colouring matter obtained from logwood, artificial *alizarine* prepared from an oil of coal gas. The discovery of this substance is regarded as a great triumph in chemistry, as it resembles the red dye obtained from madder, polyzoa, and other interesting objects.

In addition to these microscopic objects, Dr. Hallifax exhibited a number of beautiful microphotographs of his own taking; and Mr. J. Howell, pebbles picked up on the beach, showing encrinites, pentacrinites, bryozoa, cidaris spines, &c.

Before separating, it was announced that the subject for the next meeting of the Section would be *Infusoria;* that on Saturday, June 4th, the Field Excursion would be, by invitation of Mr. H. Willett, to Findon; and that the Annual Excursion would be, on Thursday, June 30th, to Balcombe, for Staplefield and Slaugham, dining at Hayward's Heath.

YORKSHIRE NATURALISTS' CLUB.

The usual monthly meeting of this club was held on Wednesday evening last, at Mr. Graham's, Market-street, in this city; Mr. W. C. Anderson in the chair.

Mr. Graham showed the following:—A remarkably fine specimen of the Peregrine Falcon (*Falco peregrinus*), shot about the end of March, at Lulworth, Dorsetshire, by T. F. Langford, Esq., and sent for preservation by Ald. Swaine, of this city; a pair of black Tern (*Sterna nigra*), shot by Col. Kaye, of Heworth; the head and leg of a Golden Eagle (*Falco chrysaëlos*), sent for preservation by G. Lane Fox, Esq.; it was remarked that the eagle had been in the possession of the family upwards of 52 years; also a very fine male Egyptian Vulture (*Vultur percnopterus*). Mr. Graham then read a letter from the Rev. J. Chaloner, of Newton Kyme, stating that he had observed what he thought to be a fine male specimen of that beautiful and rare bird, the Golden Oriole (*Oriolus galbula*), while driving, on the 28th April, on the north road, a short distance out of Doncaster.

The Rev. J. F. Blake, F.G.S., exhibited some fossils from Robin Hood's Bay, including a very fine specimen of an Echinus; a remarkably fine and tolerably perfect *Turrilites Bergeri*, and fine specimens of *T. costatus*, from the lower chalk of Ventnor, Isle of Wight; also, specimens which he thought to be internal beaks of a Nautilus, from the upper green-sand of Cambridge.

Mr. E. Allen, F.G.S., exhibited several fossils and flint implements, principally of the cutting type, from the neighbourhood of Kelsea.

Mr. Hind brought for exhibition a fine series of Tineina, including the beautiful *Lithocolletis tristrigella*, bred from elm leaves from Nottingham.

Mr. Tempest Anderson exhibited under the microscope a large series of beautiful Foraminifera, from Silesia, Ireland, and the Atlantic ooze, in which the members were very much interested.

GLASGOW NATURAL HISTORY SOCIETY.

The ninth and concluding meeting of the session was held on Tuesday week, in the Library of Anderson's University, Mr. David Robertson, F.G.S., vice-president, occupying the chair.

Mr. James Coutts exhibited a large and carefully prepared series of Post-tertiary shells from Kilchattan Clayfield, Bute, and read some remarks on the more interesting features of the district.

Dr. James Stirton exhibited specimens of *Sphaeromphale* (*verrucaria*) *Henscheliana*—a lichen new to Britain, and gathered by himself on Ben Voirlich; and

The Chairman exhibited specimens—male and female—of *Pagurus Prideauxii*, remarking that he had found the species in pairs for some years past; first, in the nets of the fishermen lifted from deep water, and subsequently in the dredge, and along the shores of Cumbrae at

low spring tides. From these instances of apparent attachment, he was inclined to think that this hermit-crab pairs for the season, and that the female, which is but half the size of the male, may, by this arrangement, share the protection of the powerful pincers of the stronger sex.

The Rev. James E. Somerville exhibited a specimen of the hooded crow (*Corvus cornix*) and its eggs, from Egypt; regarding which Mr. Gray observed that, when contrasted with Scottish specimens, both the bird and its eggs appeared to be much lighter in colour—a difference which might be owing to the nature of its food, or the results of climatic influences.

The following papers were then read:—

1. "On the Natural History of the Wood-Pigeon (*Columba palumbus*), with remarks on the extraordinary increase of the species of late years throughout the agricultural districts of Scotland," by the Secretary. The author of this paper, in the course of his remarks, showed that about eighty years ago the wood-pigeon was almost unknown in East Lothian—a county which may now be said to be the head-quarters of the bird in Britain. Within the limits of that district alone upwards of 50,000 wood-pigeons had been destroyed in the course of three years—a fact which almost proves that Haddingtonshire is yearly invaded by large migratory flocks from other countries. Mr. Gray, indeed, had actually seen prodigious flights of these birds arriving about daybreak on the coast near Dunbar; and other observers favourably situated in coast localities south of the Tweed had of late years published similar records. The wood-pigeon is known to migrate southwards from the pine-forests of Norway, Denmark, Sweden, and some parts of Russia, and on settling in a purely agricultural district like East Lothian, these flocks would not return to their native forests like fieldfares, redwings, and other strictly migratory birds, but remain satisfied with their new quarters, and thus fill the place of home-bred birds which had been destroyed.

Mr. Gray also read a communication from Lord Binning, one of the Society's corresponding members, giving the result of a series of observations on the food of this bird. From careful investigations by the author of his communication—and these had extended over a period of some years—it was conclusively proved that the wood pigeon is an agricultural pest of no ordinary kind, and that the late extraordinary increase of the species in Haddingtonshire has resulted in heavy losses to the farmers of that county. The mischief by these birds is indeed almost incredible, especially on newly-sown corn fields and fields of young grass, where they devour bushels of the leaf of the white clover. In illustration of the bird's extraordinary voracity, Lord Binning forwarded the contents of the crops of four wood pigeons opened at different times. These were exhibited to the meeting in separate boxes. The first contained 144 field peas and 7 large beans, the second 231 beechnuts, the third 813 grains of barley, and the fourth 874 grains of oats and 55 of barley. Such damage may be better estimated from the fact that the bird is known to feed three times daily, each meal probably involving the consumption of an equal quantity of grain by a single bird. In a grain-producing district, therefore, where 17,000 pigeons have been destroyed in less than ten months without affecting any apparent decrease in their numbers, the loss to agriculturists must be enormous. The statistics given by Lord Binning embraced the results of his observations over a period of nine months, beginning with August and ending with May; and after making due allowance for the bird's habit of feeding upon the seeds and roots of noxious weeds (upwards of 700 pigeons having been examined by his lordship) it was found that any slight benefit of this nature was more than counterbalanced by the excessive consumption of grain. Lord Binning also referred to the habit of this bird in attacking fields of Swede turnip, and remarked that, although it had been accused of breaking into the bulb, he was not of opinion that the bill of the wood pigeon could accomplish this. He had been informed by the Earl of Home, who had watched the proceedings of the birds, that in severe frosts they seemed to feed on little else than turnip bulbs, which they appeared to hollow out successfully; but in these cases Lord Binning presumed that rooks and partridges as well as hares had preceded the pigeons in their work of destruction. There could be no doubt, however, as to the fact of the pigeons eating the leaves or shaws, and thus checking the growth of the turnip in its earlier stages.

At the close of the paper Professor Alexander Dickson, of Glasgow University, one of the vice-presidents, spoke of the importance of such contributions, both from a scientific and an economic point of view, as they enabled naturalists to judge of the propriety of encouraging or destroying certain animals, just as they were found to be beneficial or the reverse. He then proposed that the thanks of the Society be transmitted to Lord Binning for his very interesting communication, which was cordially agreed to.

2. "Dredging Notes from the Bay of Rothesay," by Dr. John Grieve. This paper was illustrated by a large series of carefully preserved objects, and embraced many interesting facts in connection with some of the species.

3. "Contributions towards a Moss and Lichen Flora of Combræ," by Walter Galt, Esq.

4. "Notes of a Botanical Trip to Ben Lawers with Dr. Stirton, in 1868," by the same author. In this paper several rare plants were enumerated, including a number of interesting lichens.

The following donation to the library was announced:—"Transactions of the Natural History Society of Northumberland and Durham," Vols. I., II., and Part I. of Vol. III. 8vo., plates. 1865. From the Society.

After a few remarks from Professor Dickson on the progress of the Society during the past year, the session was declared to be closed.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

PARIS, MAY 30TH.—At this meeting Mr. Joule was elected as correspondent for the Section of Physics, as successor to M. Magnus, lately deceased, at Berlin.

M. Cahours presented a work in the names of MM. H. Gal and J. Gay Lussac, on some homologous compounds of tartaric and malic acids.

Many other presentations of memoirs were also made by members in the names of different authors.

M. Blanchard brought forward a memoir by M. Mandl, on the register of the human voice, which indicates the different forms under which the epiglottic orifice presents itself during the emission of the head voice and that of the chest.

M. Blanchard also presented a paper by M. Lacaze-Duthiers on the embryology of Ascidians.

M. Claude Bernard brought forward some experiments of M. Bréant, on the absorption of oxide of carbon by the blood during the inspiration of this gas; and on its fixation, which causes the annihilation of the functions of the globules of blood, and can occasion immediate death sometimes even after one inspiration. M. C. Bernard also presented some experiments made by M. Masius on the spinal cord, which tend to show that after a lesion of structure there is a regeneration of the organ. The paralysis caused by the lesion disappears, and that on this renewal of the functions the voluntary movement reappears a certain time before sensibility.

M. Charles Robin brought forward some experiments on muscular contractility under the influence of electric currents. These experiments tend to show that action is produced by the current when it is continuous, and absence of action when an induction current is made use of.

M. Jamin presented a note by M. Trève, containing some remarks on the simultaneous passage of two Rumkhorffs' currents through the same tube.

M. Balard presented a note by M. Schœrer-Kestner, relative to the action of hydrochline acid on oseine.

M. Duméril presented some anatomical observations of M. Georges Pouchet on the *Cyprinidæ* of China; and some observations of M. Moreau on the Amphioxus.

General Morin presented a paper by a correspondent of the Academy on the rupture of hollow projectiles by the congelation of the water contained in them. M. Morin, after having remarked that this fact is already known by artillery-men, remarked that he did not think it possible to make use of these experiments (as the author of the paper thought) in order to calculate the force capable of producing this rupture. In this circumstance two effects are produced, one contrary to the other; dilation of the water by congelation, and contraction of the hollow projectile by cooling.

M. ——— then read a paper on the mortality of infants.

The Academy then resolved itself into a secret committee.

NOTES AND MEMORANDA.

Speed of Electric Signals.—Professor Gould has found that the velocity of the electric waves through the Atlantic cables is from 7,000 to 8,000 miles per second, and depends somewhat upon whether the circuit is formed by the two cables or by one cable and the earth. Telegraph wires upon poles in the air conduct the electric waves with a velocity a little more than double this; and it is remarked, as a curious fact, that the rapidity of the transmission increases with the distance between the wire and the earth, or the height of the support. Wires buried in the earth likewise transmit slowly, like submarine cables. Wires placed upon poles, but slightly elevated, transmit signals with a velocity of 12,000 miles per second, while those at a considerable height give a velocity of 16,000 or 20,000 miles.—*Journal des Telegraphes.*

Royal Dublin Society.—The closing lecture of the series of afternoon scientific lectures at the Royal Dublin Society for the present session, was delivered by Mr. Tichborne, Chemist to the Apothecaries' Hall, Dublin, on May 14th. The subject was "Atmospheric Dust." This, says the *British Medical Journal*, the lecturer defined, in the words of Bacon, to be "the little motes that in the sun do ever stir, though there be no wind." Several interesting experiments were made, by which the presence of dust was demonstrated, as likewise its organic nature. Mr Tichborne also reported the results of various analyses of street-dust, which he had instituted to illustrate his lecture. He found, amongst other things, that, whereas about 36 per cent. of the dust in Grafton-street—one of the busiest and most crowded thoroughfares in the city—was composed of stable-manure, a cab-stand in Nassau-street—close to the extensive opening of the College Park—yielded a dust which contained no less than 45 per cent. of organic matter. Consequently, cab-stands were essentially sources of atmospheric contamination, and as such required careful supervision. Street-dust Mr. Tichborne described as being the pabulum of atmospheric dust in general. In concluding his lecture, the author pointed out, on the one hand, the importance of instituting a thoroughly scientific inquiry into the effects of this atmospheric dust on the hygienic conditions of places and countries; while, on the other, he alluded to the danger of raising a "dust-mania," from which much harm might result.

Recent Works on the Embryology of Articulates.—The *Monthly Microscopical Journal* gives the following useful summary in its April number:—"Professor Claparède has published a paper, 'On the Embryology of Worms,' especially Spirorbis, in Siebold and Kölliker's 'Journal.' Melnikow writes in 'Wiegmann's Archiv,' 'On the early stages of *Tania cucumerina*,' with a few figures. Dr. Richard Greef publishes in the same number of the 'Archiv,' some most interesting researches on certain remarkable forms of Arthropoda and worm-types, illustrated by four plates. Dr. Anton Dohrn has lately published the first part of his 'Researches on the Structure and Development of Arthropoda' (Insects and Crustacea), with nine excellent plates. It is extracted from Siebold and Kölliker's 'Journal.' He here records his observations on the embryology of Cuma and allied genera, of certain sea spiders (Pycnogonidæ), and thinks that embryology shows that these curious animals, classified by many naturalists with the Arachnida, are really Crustacea; and of Daphnia, Praniza, and *Paramhura Costana*. A paper of the greatest interest to entomologists is M. Ganin's 'Contribution to a Knowledge of Developmental History in Insects' in Siebold and Kölliker's 'Journal.' It is fully illustrated."

Poisonous Tea.—The trade in the lowest class of adulterated tea still continues, and this month Dr. Muter reports that there have been no less than 80 chests exposed for sale, of which he procured samples. This so-called tea consisted of a variety of rubbish, and is being sold for 2¾d. per lb. It yielded an ash amounting to 22·86 per cent., consisting chiefly of iron filings, and under the microscope presented the structures of many foreign vegetable matters. But the worst sample which came under his notice was a green tea from India, highly faced, and yielding an ash containing a quantity of copper. This is really a sad thing, because it has previously been a noteworthy fact, that our Indian planters refrained from such practices, and that tea from our own possessions could be depended on. We trust, however, that this prompt discovery and exposure, of what we think is the first case, may discourage the unprincipled persons who are thus disgracing the commercial honour of our Indian planters. The colour seemed to have been produced by roasting in contact with copper, probably in copper pans.—*Food Journal.*

A Plague of Beetles.—A very serious plague of small brown beetles has occurred in Yorkshire, and during the last few days the Swede turnip crop has been destroyed. This is especially so in the Wold district, many farms having no plants remaining. At Malton, on Saturday, the farmers obtained new stocks of seed, and re-sowing would commence on Monday. The beetles, in myriads, have also attacked the tare and pea crops. The long drought is supposed to have favoured this destructive visitation of insect life.

SCIENTIFIC DIARY.

WEDNESDAY, June 8th.

Geological Society, 8 p.m. 1. "On the Superficial Deposits of the South of Hampshire and the Isle of Wight." By Thos. Codrington, Esq., F.G.S. 2. "On the Relative Position of the Forest-bed and the Chillesford Clay in Norfolk and Suffolk, and on the Real Position of the Forest-bed." By the Rev. John Gunn, M.A., F.G.S. 3. "On *Dorypterus Hoffmanni*, Germar, from the Marl-slate of Midderidge, Durham." By Albany Hancock, Esq., F.L.S., and Richard Howse, Esq. Communicated by Professor Huxley, F.R.S., F.G.S. 4. "On a new Labyrinthodont Amphibian, from the Magnesian Limestone of Midderidge, Durham." By Albany Hancock, Esq., F.L.S., and R. Howse, Esq. Also communicated by Professor Huxley. 5. "On *Proterosaurus Speneri*, Von Meyer, and a new species, *Proterosaurus Huxleyi*, from the Marl-slate of Midderidge, Durham." By Albany Hancock, Esq., F.L.S., and R. Howse, Esq. Also communicated by Professor Huxley.
Royal Microscopical Society, 8 p.m. "Experiments on Fermentation and Parasitic Fungi," by John Bell, Esq., of the Laboratory, Somerset House; and "On a New Form of Binocular Microscope," by John W. Stephenson, F.R.A.S.
Royal Literary Fund, 3 p.m.
Archæological Association, 8 p.m.
Royal Society of Literature, 4 15 p.m.

THURSDAY, 9th.

Zoological Society, 8.30 p.m.
Mathematical Society, 8 p.m.
Royal Institution, 3 p.m. "Electricity," by Prof. Tyndall.
Brighton and Sussex Natural History Society, 8 p.m. "On Nervures of the Wings of Insects," by Mr. H. Poake.

FRIDAY, 10th.

Astronomical Society, 8 p.m.
Royal Institution, 3 p.m. "On the Ammonia Compounds of Platinum," by Prof. Odling.
Quekett Club, 8 p.m.

SATURDAY, 11th.

Royal Botanic Society 3.45 p.m.
Royal Institution, 3 p.m. "On Comets," by Prof. Grant.

SUNDAY, 12th.

Sunday Lecture Society, 8 p.m. "On The Writings of Turgot," by W. B. Hodgson, Esq., LL.D.

MONDAY, 13th.

Royal Geographical Society, 8.30 p.m.
Society of British Architects, 8 p.m.
London Institution, 4 p.m.

TUESDAY, 14th.

Royal Medical and Chirurgical Society, 8.30 p.m.
Photographic Society, 8 p.m.
Anthropological Society, 8 p.m. "On the Kelts of Ireland," by Dr. John Beddoe, Pres., A.S.L. "On the Irish Celt," by Henry Hudson, Esq., M.D. "Notes on the Race-Elements of the Irish People," by Mr. G. H. Kinahan.
Birmingham Natural History and Microscopical Society, 7.30 p.m. "On the Preparation and Mounting of Palates of Molluscs," by C. Pamphrey.

WEDNESDAY, June 15th.

Meteorological Society, 7 p.m. Annual Meeting, Election of Officers, &c.

BAROMETER OSCILLATIONS.—"J. R. T."—We have received the manuscript, which is of considerable interest. Without illustrations, however, its meaning would be unintelligible, and it would not be worth our while to have a block specially engraved for the purpose.

FLINTS IN CHALK.—"T. B."—Yes. Consult Dr. Wallich, who has given much attention to the subject. We do not think the hypothesis deserves much credence. It is too difficult to admit all the requisite conditions.

ON EOZOON.—Our correspondent's letter has reached us. We will see in due course what can be done. We could not, without fear of offence, suggest that the person named was going on a natural history expedition to the antipodes. Was it not a joke?

BOSTON SOCIETY OF NATURAL HISTORY.—"R. B."—We thank you for your communication, which has just reached us.

ROYAL MICROSCOPICAL SOCIETY.—"A. S." should ask the assistant secretary to explain the matter. It is no fault of ours.

ELECTRO-MOTIVE MACHINES.—"Ignoramus."—We cannot say what the cost is. Several such have been devised, and are described in the books on Electricity. The late Sir A. Snow Harris described in his small manual an apparatus of the kind mentioned for propelling a small boat. The difficulty lies only in the cost and not the principle. The Americans are doing more in this direction than we are.

SUNDAY LECTURE SOCIETY.—The notice has been received, but was already in hand. Have you observed our request in a recent number?

WEDNESDAY, JUNE 15, 1870.

THE BRITISH ASSOCIATION SEWAGE COMMITTEE.

THERE seems to be some fatality hanging over the question of the best means of utilizing sewage; for whenever the problem has presented itself, something, either in the shape of personal difference or trade chicanery, has cropped up to prevent the proper solution of the difficulty. We are reminded that History repeats itself, by the fact that in the recently appointed Committee to investigate the sewage matter, a split has arisen, which is likely to prevent, or at least diminish the value of, the result expected by the public.

A very pretty little squabble, traceable in some measure to personal jealousies, has taken place among some of the leading members of the Committee, and the consequences are still in embryo. The history of the affair is told in a series of documents which Messrs. Paul and Wanklyn have circulated among those interested in the sewage question. The Committee was appointed to consider the methods most appropriate for the utilization of sewage; and in the course of its proceedings it has divided on the question of the mode of applying the funds which the subscribers have already contributed in aid of the Committee's labours. Professor Wanklyn and Dr. Paul, who have themselves conducted numerous experiments on the subject, consider that the Committee should award them compensation for the time and trouble involved in such researches. To this, Dr. Williamson and Professors Marshall and Corfield object. The issue is, therefore, a very simple one, and is as to whether members of the Committee are to be remunerated for any researches undertaken to settle the question which engages the consideration of the Committee. Messrs. Wanklyn and Paul say Yes; and Professor Williamson says No.

Now, we cannot understand on what principle Professor Williamson defends his view on the matter. It seems to us that if certain members of the Committee are better qualified than others for the task of special investigation—and surely this may be said of Messrs. Wanklyn and Paul—the Committee ought to be delighted to secure the services of these gentlemen, and to reward them for the time and trouble spent in prolonged and special inquiries. Professor Williamson's objection, that only paid servants of the Committee can undertake such duties, is a mere technical objection, and is, so far as concerns the result which the public desire, a most inequitable one. It amounts to a mere cavil. Professor Williamson does not care to commence the necessary research himself, and so he tries to prevent other able chemists from doing so, on the mere quibbling ground of their being members of the Committee. What was the Committee appointed for, but to inquire into the subject—in great part a chemical one—and to report to the public? It was for such a report that the money was advanced by the subscribers; and we believe we are correct when we say that the subscribers always expected that the scientific members of the Committee would conduct part of the inquiry themselves, and not be content with sitting down in the Committee-room for a certain number of hours and examining evidence which might perchance be forthcoming.

In our opinion, then, Dr. Paul and Mr. Wanklyn are right in the course they have adopted in appealing from "Cæsar" to the subscribers, and we congratulate them on the view taken by the mass of those with whom they have communicated. We trust that these gentlemen will not be discouraged by any mere factious opposition; but, bearing the desires of the subscribers in view, that they will try and give us the facts necessary for a practical answer to the question: How shall we utilize sewage? We hope also that Professor Williamson will, in the interests of the community, forego his right to raise a technical difficulty; and, under the influence of his own sound common sense, will do his utmost to aid in furthering the interests of the public.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

DURING the past week the members of the Geologists' Association, accompanied by Professor J. Morris, made two excursions, one to Aylesbury, the other to Herne Bay. The geology of the district near Aylesbury consists chiefly of the Upper Oolitic strata; the lowest formation visible is the Kimmeridge clay, which is worked for making bricks near Hartwell, and contains many fossils, as *Ammonites biplex, Belemnites, Cardium Astarte*, &c., as well as remains of Pliosaurus; overlying the clay is a bed with pebbles, marked by the outburst of springs, and forming the commencement of the Portland series, followed by beds of sand and stone, underlying the stronger bands of Portland limestone (extensively worked at Hartwell), and replete with the usual fossils, as *Am. giganteus, Cardium dissimile, Ostrea falcata, Trigonia gibbosa*, &c. Over these a change of conditions is observed by the incoming of the estuarine Purbeck strata, consisting of shales, clays, and marly limestones (pendle), with *Mytilus, Cyrena*, many *Cyprides*, fish, and remains of insects and plants. The junction of the overlying beds is not always to be observed; but there is evidence, if not at present, at least of the former existence of the Wealden beds by the presence of the plant *Endogenites erosa*, Cyrenæ, Unio, and Paludina. Evidence of denudation is apparent prior to the deposition of the Lower Green Sand strata, which caps the hill tops at Hartwell and Stone, and contains some of its characteristic fossils, as *Exogyra sinuata, Pecten obliquus, Ostrea macroptera*, &c. Between Stone and the Chiltern Hills the overlying cretaceous beds, Gault and Upper Green Sand may be traced. The immediate district is free from much superficial deposit: there is, however, a bed of gravel and clay containing shells and mammalian (elephant) remains on the side of the clay-pit previously mentioned. The physical features of the country around are due to subsequent denudation; and thus the outliers of Portland and Purbeck strata, upon which stand Aylesbury, Hartwell, Stone, Brill, and other towns, are merely portions of these beds, once continuous, and which, as is well known, may be traced farther in a south-westerly direction, although in the other direction they are not much further to be observed. The Herne Bay excursion included the examination of the Lower Tertiary strata, so well exposed from that place to the Reculvers, and consist, in ascending order, of the Thanet sands, with its characteristic fossils, followed by the marine equivalents in that area of the more estuarine and fluviatile strata of Woolwich and Lewisham, near London, and succeeded by the basement bed, rich in fossils, of the London clay, which latter stratum constitutes the broken and sloping ground of the coast near to Herne Bay, as contrasted with the nearly perpendicular form of the cliff to the eastward, due to the difference in mineral character of the beds which compose them.

THE Museums Syndicate of the University of Cambridge have issued their annual report, from which it appears that the Swainson Collection of Birds, which has long been in the possession of the University, but not heretofore accessible, is now

arranged in new cabinets in the Zoological Museum. This collection, 2,779 in number, is mostly composed of typical specimens labelled in Mr. Swainson's own handwriting. Besides these, the Strickland Collection, consisting of 5,552 specimens, referable to 3,731 species, recently presented by Mr. Strickland's widow, is also completely arranged and catalogued by Mrs. Strickland. Another collection of birds, made by the late Mr. Selby, of Twizell-house, Northumberland, including several types of the species described by Mr. Selby and Sir W. Jardine in the *Illustrations of Ornithology*, and many of those discovered by Sir Andrew Smith, and figured by him in the *Zoology of South Africa*, has been added to the museum by the trustees of Mr. Selby; and this, and the general collection, the gift of Captain Blackwood, the Cambridge Philosophical Society, and other donors, are now all arranged in the same room. Various other acquisitions are mentioned, of which the most important is Dr. Robert Lee's anatomical and pathological collection. An index to the fossil remains of aves, ornithosauria, and reptilia of the secondary strata, in the Woodwardian Museum, and a volume on the osteology of the ornithosauria of the Cambridge Upper Greensand, with figures of specimens in the museum, have been prepared by Mr. Seeley, and are now published.

Students of statistics may be interested to know that the General Assembly of the Free Church of Scotland has presented a memorial to the Home Secretary, asking that means may be taken to get a strictly accurate account of the number of adherents to each of the religious denominations in the United Kingdom; an accurate census of the actual state of education in the United Kingdom, the number and character of the schools, by whom they have been instituted, under what management they are conducted, and the number of children attending them; information in regard to the houses of the people, to the number of hotels, publichouses, and beershops in the United Kingdom; and as to the actual numbers of those speaking respectively the Gaelic, the Irish, and the Welsh languages.

The diamond known as the "Star of South Africa," the consignment of which from the Cape of Good Hope to Messrs. Mosenthal & Co. was reported in the *Times* of the 8th of July last, having been cut, has proved a matchless stone of most resplendent quality, of about 186 grains weight. It is understood to have been sold on behalf of the consignees by the brokers, Messrs. Ochs, Brothers, of London and Paris, to Messrs. Hunt & Roskell, of New Bond-street.

The Russian Government has recently presented to the cabinet of the School of Mines, of Columbia College, U.S., a very choice collection of minerals. Conspicuous among them are nuggets of native gold, native platinum, iridosmine, large emeralds from the Urals, single and in clusters in the gangue; topaz, chrome garnet, malachites, &c., in all 456 rare specimens.

At a recent meeting of the American Geographical and Statistical Society, in New York, Mr. Paul B. Du Chaillu, the eminent African explorer, was presented, through President Daly, with a silver medal, awarded by the Imperial Geographical Society of Paris.

The *Engineer*, which is usually well informed on such subjects, states that one of Thomson's patent steam omnibuses has begun to run regularly between Edinburgh and Portobello, a distance of about three miles. The omnibus is constructed to carry sixty-five passengers—twenty-one inside and forty-four outside. The trips already made have been very successful.

The Lords of the Admiralty have decided on immediately building three iron vessels of war, at Chatham dockyard, in addition to those now under construction and fitting at that establishment. The largest and most powerful of the new vessels is to be named the *Raleigh*, and will be of between 4,000 and 5,000 tons burden, mounting an armament of 27 heavy guns, placed in her armoured interior. The other new vessels are to be named respectively the *Scourge* and the *Snake*, both being iron gun vessels of a comparatively light draught, to enable them to enter harbours and carry on operations in rivers and along the coast.

At a meeting held at Folkestone on Monday night, 6th inst., on the subject of the Channel passage, it was stated that the directors of the South Eastern Railway intended, up to the beginning of May, to oppose the Folkestone ferry boat scheme, in connection with the Great Northern of France, but that company made terms with the advocates of the scheme; and the South Eastern, being taken by surprise, dropped their opposition in the Commons, but reserved their right to oppose in the Lords, where, they state, they hope to upset the scheme and bring forward a plan for preserving all the advantages it offers at a greatly lessened expense. They propose to extend the harbour of Folkestone and build boats similar to those on the Holyhead service, and so to make the passage in one hour, or the journey between London and Paris in eight hours. Resolutions were passed pledging the town council to support the South Eastern directors, and a deputation was appointed to wait on the maire and municipality of Boulogne asking their co-operation.

Messrs. Laird Brothers write to the *Times* to express their opinion that no conclusion as to the merits of the ships *Monarch* and *Captain* should be drawn from their performance in a passage of ten days to join the Channel squadron, when the relative previous experience gained in each ship is considered. The *Monarch* has been in commission for more than a year, but the *Captain* for only ten days, when she left to join the fleet. They add:—The reports we have received from those on board the *Captain* speak in the highest terms of her handiness, her seagoing qualities, her arrangements as a fighting ship, and also of the excellent practice made from her turret guns in heavy weather, and confirm the personal observations of one of our firm, who made the passage in her to join the fleet off Cape Finisterre.

The *Pall Mall Budget* says:—It is now definitely settled that four expeditions are going out to observe the approaching eclipse of the sun, which will be visible throughout a great part of Southern Europe; and that Mr. Gustave Lambert, who proposes to undertake an expedition to the North Pole, declares that the statement of his having made up the necessary funds is unfounded.

We learn from the Science Gossip of the *Athenæum* that the Royal Academy of Sciences of Turin has found in its secretary, Signor Gaspare Gorresio, an able chronicler of its proceedings; his recent work, *Sunto dei Lavori Scientifici letti e discussi nella Classe di Scienze Morali, Storiche e Filosofiche della Reale Accademia di Torino*, contains the discussions from 1859 to 1865, since which year the Academy has published special reports.

The Botanic Garden at Rotterdam, directed by Dr. Ranwenhoff, and in which M. Witte acted as head gardener, is to be given up. The *Gardener's Chronicle* does not know the reasons for this step.

Lord Napier's Government is maturing a most important scheme for *training Native medical practitioners for village and district dispensaries* in India. It is proposed to establish medical schools—two in the Telugu districts, two in the Tamil, and one among the Malayalum-speaking races. The course of study, embracing a popular system of medicine and surgery, would extend over three years, and the students would take the place of the *hakims* and charlatans who now victimize the masses. Under this scheme, some eight or ten qualified practitioners would be sent forth from each school, until there was at least one village doctor to every 3,000 people. It would, of

course, be the work of years to provide so many practitioners as 8,500; but we know of no project likely to confer a wider benefit upon future generations. The Local Fund and Town Improvements Bills have interrupted the consideration of the scheme, which will be resumed as soon as these measures become law.

We do not know on what plan the examinations of the Royal Agricultural Society are conducted, but we must distinctly dissent from the opinion expressed in the following quotation from a contemporary:—"The utter failure of the examinations held by the Royal Agricultural Society is a noteworthy fact. This year only two candidates presented themselves, and we are, therefore, not surprised that the report should be silent on the subject of education. It is a great thing to learn that there are some branches of knowledge wherein proficiency cannot be tested by examination papers, even when framed on the best possible principles. Mr. Dent expressed the feelings of most landlords and agents when he said that conversation with a proposed tenant, and a walk with him through the vacant farm, must always be a more satisfactory criterion than the diploma of the Royal or any other Agricultural Society. Knowledge and capital are the two requisites for successful farming. Examination may, perhaps, ascertain the existence of both, but will not help one to know how either is likely to be employed." If the examination was a practical one, it would surely be better than a whole week's excursion round the farm. Examiners often make the mistake of testing only the knowledge of the theory, and omitting consideration of the art. It is in this, we suppose, the defect lies. If the examinations for a medical degree were limited to paper and *vivâ voce* questions, without the test of the patient's bedside, the public would be likely (as indeed happens in the case of some degrees) to feel the consequences.

The *Pall Mall Gazette* is surprised that in the recent debate upon opium cultivation no reference was made to the curious statements of M. Garnier, a member of the French Cambodian expedition. He asserts that in China the taste for opium is by no means confined to the human race. Pigs and horses thrive upon poppy flowers, and when deprived of their favourite food languish and die. At a town in Yunan rats used to resort in large numbers to an opium manufactory, in order to inhale the fumes from the coppers; and after the town had been sacked by the Panthays, the ruins of the factory were visited by its old habitués, who were content to die on the scene of their former happiness. A great deal of nonsense is talked about the fearful consequences of opium-eating. In moderation, opium is an excellent stimulant, and this is well known to the hundreds of literary and professional men who could hardly get through their labours without its help. The stereotyped emaciated opium-eater is one of the bogies used by the well-intentioned ignorant, and has, save in exclusive instances, no serious existence.

On Wednesday last the great show of the season at the gardens of the Royal Horticultural Society took place. The display of plants, flowers, and fruit was excellent, and may be regarded as in every respect successful. The attendance of visitors was very numerous. An important feature of the show was the exhibition of rhododendrons by Mr. Waterer, of Knaphill Nursery, under the marquee. Several thousands of trees were set in groups upon undulating land, and the masses of bloom of various tints, well arranged and divided by walks, to the spectator on an elevated spot, were very effective. In the general exhibition the orchids were a remarkable collection, and the fine foliage plants were numerous and of great merit. The azaleas were not quite so good as usual.

Mr. R. Field, C.E., and Mr. C. Cubitt, C.E., the engineers deputed by the British Association to examine and report upon the sanitary condition of Cambridge, so far as it is influenced by the outfall of the town sewage into the river, have, says the *Globe*, been engaged this week in surveying the town. The engineers are taking a careful series of gaugings of the flow of sewage into the river and of water into the sewers.

The Albert Medal of the Society of Arts, which was founded for rewarding "distinguished merit in promoting Arts, Manufactures, and Commerce," has this year been awarded by the Council to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realization of the Suez Canal."

The following University notes were published on Saturday:—The chief of the newly-elected scientific examiners for the London University examinations have declared their intention of abandoning special private tuition while they hold office as examiners. In former years complaints were made, whether justly or not, that professors made use of their position as examiners to attract pupils to their special classes for the several examinations.——The new lectures on physiology at Trinity College, Cambridge, by Professor Foster, will be open to all members of the University.——The Cambridge examination for the B.A. degree in special branches of Natural Science resulted as follows:—Botany.—First Class: Duke, Corpus, Fletcher, Clare, Æq.; Gwatkin, Trin.; Davies, Qu.; M. J. Hall, Clare; Stevenson, Sid. Second Class: Hanbury-Tracy, Trin.; Johnson, Sid.; Muggeridge, Trin.; Powell, Caius; Preston, Caius; Smith, Pet.; Smith, Down.; Stevens, Trin.; West, St. John's. Chemistry.—First Class: Green, Trin.; Vores, Caius. Second Class: Beatson, Clare; Phillips, Clare. Zoology.—First Class: Pershouse, Emm. Students who have satisfied the examiners in one paper:—Botany.—Rebsch, Corpus. Chemistry.—Banks, Jes.; E. M. Jones, St. John's. Geology.—Fynes-Clinton, St. John's. Zoology.—Fitz-Herbert, St. John's.

The Nineteenth Annual Conference between the Council of the Society of Arts and the representatives of the Institutions in Union and Local Boards will be held on Wednesday, the 22nd June, at 12 o'clock noon. The chairman of the Council will preside. On this occasion, the Conference will be held in the Lecture Theatre of the South Kensington Museum, in order to afford to those present an opportunity of visiting the Horticultural Gardens, the Royal Albert Hall (now in course of construction), and the new buildings now being erected for the International Exhibition of 1871. The Council will lay before the Conference the Report of the Proceedings of the Union for the past year, and the Results of the Examinations. Suggestions in reference to the Programme of Examinations for 1871 will also be received by the Council.

How to generate steam quickly, and at the same time inexpensively, has remained one of the problems left to engineers to solve. Mr. Galloway has invented an apparatus which, whilst it does no claim to supersede all steam boilers at present in use, yet claims that it can be affixed to them readily, and, once applied, save 50 per cent. in the cost of fuel, and pay for itself within one year. These the *Builder* thinks are bold assertions, and well worthy of the consideration of those who use steam power. The invention, as we understand it, consists in the application of atmospheric air, which is first of all pumped down a pipe passing through the flue, the air being heated on its passage; the pipe is continued under the furnace, and passing through returns on the back under the fire bars; and the temperature of the air having thus become raised by the waste heat is driven into the boiler, and helps to generate steam in the chamber, the action of the piston-rod assisting the process.

According to the *Globe*, much interest is just now felt in the question as to the probability or non-probability of an extension of the Shropshire coalfield beyond the old boundaries. Scientific facts and careful observation hitherto tend to show that it suffered so much at the close of the great carboniferous period by destructive waves as to form, if not an island, cer-

tainly a peninsula, on which the ravages of such waves are yet distinctly visible. Great interest attaches to experiments Mr. Corbet, of Adderley, is making by boring at Child's Ercal, near Market Drayton, and to which not only local practical geologists, but the highest scientific authorities of the day connected with the Government Survey, have given their sanction.

In delivering his address to the students of St. Mary's Hospital (to which we referred last week), Dr. Lyon Playfair gave some curious historical illustrations of the origin of Hygiene in England. If his view of the matter is correct, the study of sanitary science arose from a singular accident. The Court and Parliament were at Oxford, which had been recently drained, and the citizens had removed all accumulation of filth and garbage from the streets, lest they should offend the nostrils of their distinguished guests. The plague was raging at the time, and Oxford was the only place which enjoyed an immunity from it. Cause and effect were for the first time connected in the public mind, which was thus enlightened for the first time as to the nature of what we now call pythogenic, or filth-born maladies. Prior to that, the measures recommended by the council of the physicians of Paris for the arrest of the plague were:—That if a shower of rain fell during the day a spoonful of treacle should be taken, and that fat people should not sit in the sun. Michelet declares that for several centuries during which filth reigned supreme, not a man, woman, or child in Europe took a bath voluntarily and out of a desire for cleanliness. Out of this chronic and widespread filth arose the black death, the plague, the sweating sickness, and other pestilences, the consequences of bad hygienic conditions.

Messrs. Buckland and Young, who were recently appointed to inquire into the condition of the Scotch salmon fisheries, have concluded their first tour of inspection. During the last month the commissioners have been actively engaged inspecting the rivers and inquiring into the various causes which militate against the increase of salmon in Scotch waters. The following rivers, says the *Pall Mall Gazette*, have been inspected:—The Forth, Tay, North Esk, South Esk, Dee, Don, Ython, Daveron, Spey, Findhorn, and Nairn. On many of these rivers there are pollutions as deadly and obstructions as impassable as those on some of our worst polluted and most formidably obstructed English streams. Dams, Dykes, poachers, fixed engines, and other enemies to the increase of fish exist in more or less degree along the rivers and coasts of Scotland. All the districts which the commissioners have so far visited have the advantage of having district boards—an advantage which is, however, possessed by a very small proportion of the salmon rivers in Scotland. It is satisfactory to learn that the appointment of the commission has met with general approval throughout the country. The meetings held by the commissioners have been well attended; information has been readily given; indeed, the whole tone of proprietors, lessees, and others interested in the salmon fisheries appears to be thoroughly indicative of a desire to facilitate the labours of the commissioners by every possible means. A very general opinion appears to exist in Scotland that the fisheries of that country should be placed under the supervision of inspectors, such as we have in England and Ireland. In both those countries the system of inspection has worked admirably, and there is no reason why the fisheries of Scotland, which are of considerably more value than those either of England or Ireland, should not have the advantage of a qualified inspector to look after their interests.

An interesting discovery of a kitchen midden has taken place at Cork, near a seaside place named Ballycotton. A recent storm, which washed away the peat from the shore, disclosed the ancient shell-mounds, which have since been examined by Professor Harkness, Dr. Caulfield, and the Rev. J. Hodges. The physical conformation of the district may be briefly described. Behind the north shore, on which the remains were found, a bog extends for a considerable distance, which is drained by a stream which flows into the sea at Ballycotton. This bog has been extensively cut away for fuel, and is now covered to a great extent by *arundo phragmites*, or bog-reed. No trees are now growing on its margin, which formerly must have been fringed with the oak, birch, alder, and hazel. From observation of the nature and conditions of this place, it is evident that a subsidence of at least twelve feet has taken place since first this coast was occupied by man. In the instance of Ballycotton, nothing was found but the broken shells; the strata of shells ran for a very considerable distance round the shore about six inches in depth, and about two feet below cultivated ground a little above high-water level. The shells were principally of the species *Purpura lapillus*, intermixed with a few limpets. Scarcely four years have elapsed since land was cultivated on the north shore, now covered by the tide. The peat was here 6 ft. thick at least; but the sea has eroded the soil, covers the place where houses stood in the memory of man, and only left behind three clumps of peat of about 3 ft. in thickness. These formed the subject of examination. It may be observed that this peat contains no traces of reeds or other marshy plants, and must consequently have been of very *slow* growth. It is entirely composed of the leaves of the oak, birch, hazel, and alder. Below this peat, and lying on the boulder clay, were found the bones of the *bos longifrons*, a small variety of horned cattle, the wild boar, the goat, and the bones of a very large bird. All the leg bones were split longitudinally, for the purpose of obtaining the marrow, as is usual with savage tribes. Heaps of these remains have been washed away by the sea, and many may even still be picked out from the shifting sand which covers this part of the strand. Some of the stones found beneath had the appearance of the action of fire, but this could not be determined with any degree of certainty. A large quantity of the bones, &c., has been removed to Cork for further examination.

According to a paper presented to the Pathological Society by Dr. Dickson, paralytic lunatics have always soft and brittle bones. This fact will be *caviare* for the keepers, who will, in future, know how to explain any half-a-dozen broken ribs or so. We really think that Dr. Dickson should have waited for further researches into the subject before publishing so startling, and, for unhappy lunatics, so dangerous a generalisation.

The general result of the investigations of Dr. Frankland and the Government Water Commission amounts, says the *British Medical Journal*, when analysed, to a denial of the current notion that sewer-water, mixed with the stream of a river, is purified by the combustive action of the oxygen dissolved in the water. He maintains, on the contrary, that there is no river in England long enough to effect this combustion completely and satisfactorily. It is true that, after a *short* distance, the river-water becomes limpid, and less loaded with organic matter; but that is because the greater part of the organic matter in suspension has fallen to the bottom, and is deposited with the mud. The source of infection has merely changed its time and place. The spores which are capable of transmitting disease resist both modes of separation. To purify sewer-water, the Commission sees no other practicable means than filtration through the earth, which it serves to manure and enrich. This filtration completely purifies it, and without danger of infectious emanations arising from the land, as might be feared.

On Tuesday last Dr. Richardson delivered the concluding lecture of his course on Experimental Medicine for the session 1869-70. It was remarkable for a very curious experiment, which appears to show that there is a direct and almost immediate passage of substances in the gaseous form through all the tissues of the body, and especially through the coats of veins, and which is thus described by the *Lancet*:—Dr. Richardson introduced a fine tube through the nostril of a rabbit into the cranial cavity. Air, or carbonic-acid gas, pumped through this tube, instantly made its appearance in the right cavities of the heart. The carbonic acid darkened the blood and stopped the

systolic action. Atmospheric air rendered the blood of the right side arterial, and restored the systole. At some future time Dr. Richardson promises to announce the results to which he may be led by following out this line of inquiry. His next course of lectures will commence in October.

Messrs. Wyman & Sons, of Great Queen-street, are about to publish "A System of Botanical Analysis, applied to the Diagnosis of British Natural Orders," for the use of beginners, by Dr. W. Hansel Griffiths.

The Council of the Odontological Society announces that, through the liberality of one of its late presidents, Mr. Ibbetson, it is empowered to offer for competition a gold medal, value twenty guineas, for the best original essay on "The Histological Structure of the Human Teeth." The scientific of all countries are invited to compete for this medal; but the essay must be written in the English language, under a motto, and sent—with *sealed* envelope, superscribed with the same motto, containing the author's name and address—to the President of the Society, 32, Soho-square, London, by the 31st of December, 1871, after which day no essay can be received. The Council does not pledge itself to award the medal, except for an essay of a certain standard of excellence; and will claim for the society the right of publishing the successful essay in its *Transactions*. May we suggest that the essays and superscribed envelopes should not be in the handwriting of the authors?

The North-Eastern Railway Company are now forming a new line between Gilling and Helmsley, which passes through the Caulkless spur of the Hambletons in a deep cutting, near Stonegrave. Here, at a depth of nearly 30 ft., a large chamber in the oolite rock has been discovered. A man named Pinkney has been down into the cavern, which he found to contain water-worn pebbles and stalagmite. He says the chamber is as large as an ordinary room, and has three openings from it, into one of which he ventured as far as he could see, but hearing water and finding a sudden descent he returned. At present the entrance is covered, but a full exploration will eventually be made. The cave is on the same horizon as the famous Kirkdale Cave.

We understand that Dr. Taylor has resigned the lectureship on Medical Jurisprudence and Chemistry at Guy's Hospital.

The lectureship on General Pathology and Pathological Anatomy at the Medical School, Surgeons' Hall, Edinburgh, has become vacant by the resignation of Dr. Grainger Stewart.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

MICROSCOPIC ORGANISMS IN MILK.

BY C. STANILAND WAKE, F.A.S.L.

In Two Parts.—Part I.

On the 1st May, 1869, I communicated to Scientific Opinion[1] the result of certain experiments I had made with milk; and this result, with certain other facts connected with organic infusions, were communicated to the British Association, at their meeting held at Exeter, in August last.[2] About the latter date, the *Journal des Connaissances Médicales* contained an account of the researches on the organic changes which take place in milk made by M. V. Esling. These changes, as there described, agreed well with my own experience; but on the 30th November last, Mr. D. R. Dancer, F.R.A.S., read before the Literary and Philosophical Society of Manchester, a paper, the object of which apparently was, to controvert the conclusions arrived at by M. Esling,[3] and incidentally, therefore, those stated by myself. Under these circumstances, I thought it desirable to repeat my experiments, for the purpose of ascertaining on which side the truth lay. Before giving the result of my further researches, it will be well to state the conditions under which they were made, these having been purposely varied. It is well known that certain coloured rays of light are particularly favourable to the development, in organic infusion, of infusorial life, while other rays are the most favourable for the production of microscopic forms of vegetable life. Thus, M. Pouchet says, that *white* light is the best fitted for obtaining the former result, after which comes the *red* ray, then the *violet*, the *blue*, and finally the *green* ray. On the contrary, for the development of vegetable "proto-organisms," the *green* ray is the best fitted; next to this the *blue* and *violet* rays; and, lastly, the *white* light; the *red* ray hindering the development of these organisms.[4] To ascertain the influence of certain rays on milk, one portion was placed in a yellow bottle, another in a blue bottle, and a third portion in a green bottle. Moreover, the milk exposed to white light was placed under varying conditions. In one instance it was diluted with distilled water, while, in another, the bottle containing it, instead of being stoppered, was merely covered over with paper—so arranged, however, that it would be very difficult for the external air to make its way into the bottle. The experiments were all made and concluded between the 26th of January and the 11th of March last, the bottles containing the milk being exposed to diffused light in a room in which a fire was seldom lighted until evening, so that the average temperature would probably be much the same as that to which the milk investigated by Mr. Dancer was exposed. It should be stated, that the milk used for the experiments to be detailed was from the Highgate suburban district, and from a dealer whose milk is in good repute.

1. *White Light. Milk in corked Bottle.*—Of this, not many observations were made, because its appearance confirmed exactly what I had before stated as to the organic changes presented by milk exposed to similar conditions. After standing for eight days, the milk presented to the eye the appearance of a watery fluid having an opaque surface covering, with a white fluffy sediment, answering to the flaky precipitate of Mr. Dancer's milk, due to the coagulation of the casein. On examining the surface film under the microscope, it was found to consist of filaments of fungoid growth, in most cases showing clearly the cell formation. These filaments, which were often branched, appeared to have originated from the connection of certain nearly oblong corpuscles, of which numerous specimens were visible in the fluid part of the "infusion," sometimes two or more of them being united endwise. Many of the milk globules had lost their round form, and were more or less swollen; some of them closely resembling the corpuscles united to form filaments. Sometimes several of these globules were united without much loss of form. The fluffy sedimentary matter was made up of numerous small bodies which appeared to be matted together, there being associated with it a minute fungoid growth, differing considerably from the filament of the surface. In addition to these forms were multitudes of very small bodies, probably bacterial germs, the origin of which I ascribe to the fungus of the surface-film, the cells of this fungus sometimes containing small bodies apparently of a similar character. Examination of this infusion nine days later (seventeenth day) shewed that the characters already described had become more pronounced, the milk itself having an extremely offensive smell. Most of the globules had lost their original form, many of them being oblong, although

[1] No. 27, vol. i. p. 516.
[2] See *The Monthly Microscopical Journal* for December, 1869, p. 307.
[3] See Scientific Opinion (No. 60), vol. ii. p. 680.
[4] *Hétérogénie* (1859), p. 197.

these were round when an end view was presented to the eye, showing that the change of form had operated only in one direction. Some of the globules were detached, but others were united in chains of various lengths; and occasionally these bodies had sent out shoots, evidently the beginning of fungoid stems. The sediment had the same "matted" appearance as on the first examination, and there was the same abundance throughout the infusion of the minute germs, in addition to numerous fully developed bacteria.

2. *White light: Paper-covered Bottle.*—This milk also was examined eight days after it was placed in the bottle, and it was found to present exactly the same general characters as No. 1, although the fungoid growth may have been rather more fully developed, and bacteria had already been produced. Three days later (eleventh day) the surface film of this "infusion" had become thick and firm, through the increase and interlacing of fungoid stems. There was, moreover, a greater formation in this than in No. 1 of irregularly-shaped bodies of gelatinous appearance, apparently at the expense of the globules; and also a more abundant development of bacteria. I kept this milk for a longer period than No. 1, and, twenty days after it was first examined, the surface fungoid growth had almost disappeared, and had given place to numerous bodies somewhat narrower at each end than in the centre, several of which were occasionally united endwise and to a vast number of minute and extremely active organisms, such as are developed in the decomposed yolk of a bird's egg. Similar phenomena were presented by the bottom layer, which, however, still retained much of its original "matted" character.

3. *White light: Milk-and-Water Infusion.*—Three days after this infusion was formed many of the surface globules presented a swollen appearance, and some of them were of an oval form. The lower parts of the fluid showed the same peculiarity as Nos. 1 and 2, the result of the precipitation of the caseine matter. On the sixth day the infusion was somewhat sour, and its upper portion had a fluffy appearance, with a surface film *not* of great consistency. Under the microscope it had much similarity to the sedimentary matter, but it was accompanied by a minute fungoid substance, and also by long homogeneous fibres, such as were occasionally produced in the other infusions, but not so abundantly. Many of the globules gave signs of budding. Bacteria were abundant. By the eighth day, fungoid filaments similar to those of the surface film of Nos. 1 and 2 had been developed, but not yet abundantly; the bacteria had increased, and presented several peculiarities. Some of them were broad, like short fibres; while in some instances they were long and narrow, and apparently formed by the junction of ten or twelve minute bodies. I find, from my notes, that bacteria were not so abundant in this infusion as in milk exposed to the yellow rays for an equal period. It agreed, however, with the latter in having a number of pale semi-transparent bodies of a peculiar character, and which I afterwards met with in several of the other infusions. On the next examination, the fourteenth day, the infusion was much more sour. Many gelatinous-looking bodies, usually oval in form, were found; several of them being at times grouped together. Smaller bodies were occasionally united together in chains, but the chief peculiarity was the tendency possessed by the globules to form a clotted mass. On the twenty-third day the infusion was extremely sour, and its general character was much the same as that of the milk exposed to the yellow light for the same period. Thus, towards the surface was a considerable quantity of fungoid growth, and at the bottom much of the matted substance, distinctive of the sedimentary deposits of Nos. 1 and 2. There was, moreover, a further development of the curious pale, almost transparent, bodies or cells noticed on the eighth day, and of the smaller and more opaque globules; in some cases several of these being united together endwise.

4. *Yellow.* The milk placed in a yellow bottle was examined on the third day, when the only changes observed were an apparent increase in the size of some of the globules, and a tendency in those of the lower part of the fluid to cluster. The surface-film was, of course, thicker than the body of the milk, but it was not firm, or "moulded." On the sixth day the film was not much altered. Among its globules, however, were numerous patches of pale, semi-transparent bodies of the same character, apparently, as those in No. 3. Some of the ordinary globules were swollen, as though sprouting, and in the bottom part of the infusion these were "matted," and accompanied by the same fungoid appearance as the sedimentary formations of the other infusions. Bacteria-like bodies were numerous. On the eighth day the smell of the milk was very offensive, and the infusion contained great numbers of bacteria of various magnitudes. The fungoid growth was more fully developed in the surface-film, there being many independent oval cells, while the ordinary globules had somewhat clustered, or become irregular in shape. The pale semi-transparent cells were much increased in number, sometimes several of them being joined together. The characters presented on the fourteenth day agreed well with these; the globules had evidently a greater tendency to cluster than to give rise to the formation of the fungus, and this even at the surface. On the twenty-third day the surface-film was still far from firm, although it contained a considerable quantity of the usual fungoid filaments. Many of its globules were clustered, and it contained, moreover, many of the semi-transparent bodies already mentioned, singly or united. These were present also in the lower part of the infusion, as were some of the ordinary globules, occasionally joined together like stringed beads. Many of the larger oval cells were evidently derived from the original globules. The infusion was at this date extremely sour, but, nevertheless, I kept it for a considerable period longer, to see the result. Ten weeks after the milk was first bottled its surface-film was still firm. On examination this appeared to consist of myriads of minute and active organisms, associated with great numbers of the curious bodies I have described as semi-transparent cells; the other part of the infusion consisting chiefly of these, with a certain proportion of globules, many of which were variously altered in form.

5. *Blue.* The milk contained in the blue bottle presented, at the expiration of three days, much the same appearance as No. 4 (yellow). The most curious phenomena was one which I observed also in No. 4. This was a kind of attraction and repulsion which some globules appeared to exert over others. One globule, which moved about and exercised a repellent influence, had a fibrous appendage, which moved rapidly from side to side. The under portion of the fluid contained many irregularly-shaped pieces of substance, and various bodies, usually oval, but somewhat narrower at one end than at the other (see No. 2). It struck me that these had a slow movement through the fluid, but whether proper to themselves or not I cannot say. On the sixth day the surface-film was thick but not firm; the globules showed a tendency to cluster, and some of them were swollen, or sprouting. Bacteria were not uncommon. The lower portion of the fluid afforded much the same result as the analogous portion of No. 4 (yellow). Examination on the fourteenth day revealed a considerable increase of the clustering tendency of the surface globules, with fibrous formation, the mass being intertwined with occasional fungoid stems. In one instance five globules were united together in a peculiar manner—the largest one having four others attached, not in one, but in two rows. This infusion was not so sour as that in the yellow bottle, but on the twenty-third day it was extremely so. At this date, in addition to a certain quantity of fungoid filaments, the surface-film contained numerous globules or cells, of various sizes and different degrees of transparency, most of them being either independent or united two together. Each cell showed a nucleus, the size of which evidently had relation to that of the cell itself, which, moreover, in some cases, had the appearance of sprouting. Occasionally, several of these cells were united so as to form a chain or a long

fibre. The lower portion of the fluid presented the same characters as those exhibited by the sedimentary deposits of other infusions. Throughout the fluid were numerous minute spherical bodies, which moved freely.

6. *Green.*—The milk was put in the green bottle at the same time as No. 1, and when examined on the eighth day it showed little trace of change beyond the clustering of the globules. By the eleventh day the usual fungoid filaments had begun to show themselves, presenting, however, the peculiarity that they were generally much broader and the cells longer than in other infusions. Each of these cells evidently possessed a nucleus. The lower portion of the infusion had the same appearance as the sedimentary portion of the other infusions. Bacteria were numerous. On the seventeenth day the fungoid formation had somewhat increased in quantity, but it was not so abundant as in No. 1. Much of it, however, was pale and semi-transparent, like the globules or cells of this character observed in Nos. 3 and 4. Many of these cells also were present in this infusion. The tendency of other globules to cluster still continued. The smell was not nearly so offensive as that of No. 1. This infusion was kept for eleven days longer (twenty-eighth day), and then the pale semi-transparent cells were found to be more abundant, and to be often united together, occasionally several of them forming a chain, or being amalgamated into a filament. Their oval form and general appearance gave them much similarity to infusoria, but they had no movement. The ordinary globules were more irregular in shape than in most of the other infusions, and some of them had become oval and united, so as to form stems, but these were not so plentiful as in other infusions. Bacteria, also, although plentiful, were not so large or active as in some infusions. The lower portion of the fluid contained a great quantity of the sedimentary deposit, with smaller fungoid formation. The smell of this infusion, although very offensive, was not so much so as in other cases.

The result of the experiments with coloured rays would appear to confirm well the statement of M. Buchet as to the influence of these rays on organic development. We have seen that the fungoid filaments of the infusion exposed to the green light were larger than those of the other infusions, while the tendency to the formation of these filaments under the influence of yellow light was but feebly exhibited, although bacteria were very plentiful.

HOW TO COLLECT AND STUDY INSECTS.

BY. F. G. SANBORN, OF BOSTON, MASS.

ONE can scarcely walk a mile in the country without obtaining some object to grace his cabinet, or observing some fact in natural history to add to his storehouse of mental treasures. It should be borne in mind by the student collector that, notwithstanding he may propose to confine his studies to one order of insects, he should also contract a habit of observing and collecting those of other orders, as well as such small and portable vertebrates and other invertebrates as his opportunities may enable him to capture and preserve. Alcoholic specimens of mammals, birds, fishes, reptiles, mollusks, crustacea, and facts concerning them, are marketable commodities in the exchanges of Science. Especially should this plan be carried out by the collector who may be established for a term of months or years in a region remote from libraries and museums. Such study and investigation in this field as his time permits, will of itself materially enlighten his mind upon the secrets of Nature; and, although destitute of books—those records of repeated failures and few successful attempts to unmask Nature's protean face—he may learn the structure, habits, and comparative intelligence of the creatures around him. A subsequent opportunity may occur for him to ascertain, if so disposed, the different technical names imposed upon "Mouse, No. 7," "Bird and Nest, XII," or "Bug, No. 427," and accepted by the scientific world.

Should he care only to acquaint himself with the nomenclature of some limited group or order, and wish to increase his cabinet in that specialty, he will find that he has the powers of a capitalist to invest his miscellaneous collection of specimens and facts in such manner as he may prefer. Thanks to the diversity of tastes implanted in us, there is always some eager specialist—individual, or backed by an association,—standing ready to give full value for, and "work up," this or that portion of such material.

The practice of noting (with *ink*, if possible), in a small blank book, or on cards, such facts and observations as he may make or discover, adds immensely to the value of any collection, and cannot be too strongly recommended to the collector. The date of capture of a specimen, of the transformation from the egg, larva, or pupa, of the appearance or disappearance from its usual haunts, and such other items of interest that arise in connection with the specimen, are of importance to the student, and should be therein set down. A small tag or ticket of paper attached to the dry specimen, or of parchment, leather, or soft metal to the alcoholic, and bearing a number corresponding to that in the note-book, renders the information thus obtained available, and sufficiently identifies the specimen. As the collector pursues his investigations month after month, he will find his senses becoming educated to a delicacy of touch and fineness of perception that cannot fail to be a source of pride and gratification to him. He whose attention would not at first be diverted to the ragged leaves of a caterpillar-ridden tree, will in a few months notice instantly the slight convexity of outline on twig or leaf caused by the presence of a small insect, or the extremity of a branch cleanly cut by a pruner-beetle.

In the course of his observations he will be amused by the imitative shapes and colours of many forms of insect life, and will frequently be deceived by the Curculios, who successfully simulate buds and bits of bark. The caterpillars of some of the moths resemble so closely cylindrical twigs, as many of the Loopers (*Geometridæ*); scales of rough or smooth bark, as the Hag-moth (*Limacodes pithecium*) and the Lappet-moths (*Gastropacha velleda* and *Americana*). Some of the beetles, as the *Crytocephali* and *Histers*, closely resemble seeds, as do certain Bugs, among them *Corimelaena*, and the two latter suggest such kinship as to cause them almost invariably to fraternize in the cabinet of the amateur. These singular resemblances are called mimetic forms; and, existing everywhere in Nature, even if they have no high significance and serve no better purpose, educate our perceptive powers to a degree undreamed of by the careless horde of money worshippers.

During the active season of the insect year the collector should make it a rule never to stir abroad without a cork-stoppered vial half filled with alcohol, for the temporary deposit of beetles, ants, or the larvæ or pupæ of any insects that it may be desirable to preserve in this way. The only insects that are irrecoverably injured by a few days' immersion in pure alcohol are the butterflies and moths. For these a small cork or pith-lined pocket-box, of convenient form and full 1½ in. in depth, containing a few insect pins of various sizes, is indispensable, and should be a constant companion. Upon a premeditated excursion of a day or more in duration, the collector will naturally provide more extensive means of transportation, such as jars of alcohol, a vial of chloroform, a number of old envelopes, and a larger box slung on the side with straps, and a proportionate stock of pins. Some collectors continually carry, in a pocket made for the purpose, a wide-mouthed vial, like a chemist's test-tube, "of the same size all the way up," containing at the bottom a few grains of cyanide of potassium, which is kept in place by a wad of cotton, felt, or thick cloth, neatly pressed down upon it. This prevents the cyanide, which is a deadly poison, from touching or soiling any delicate insect, and allows the powerful vapour to destroy, as it does almost instantly, the life of any insect that may be inclosed in the prepared vial. The permanence of this poison (its virtue

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enduring for a twelvemonth or more), its cleanliness, and cheapness, render it perhaps the most convenient and desirable "life-annihilator." It is, perhaps unnecessary to mention that the vial should be kept tightly corked, and that the insect should remain therein not much more or less than ten minutes. A vial, 1 in. in diameter and 4 in. in length, made of strong glass, is the most desirable size. Some collectors carry a small vial of chloroform, through the cork of which passes a very small tube of metal; what is called by jewellers "hollow wire," of minute aperture, is used for this purpose. This instrument is used for conveying a limited quantity of chloroform to the spiracles of the insect, without deluging and damaging much of its plumage, if furnished therewith. Ether, as well as chloroform, is sometimes used in lieu of the cyanide, but it has to be continually supplied from another reservoir. In some countries bruised laurel-leaves are placed in the bottom of the vial, or a small packet of them pinned in a corner of the collecting-box, inclosed in a little bag or wisp of loosely woven cloth, such as lace, book-muslin, &c. All of these poisons act at first only as anæsthetics, or stupefiers, and should be continued in use sufficiently long to destroy vitality, or to prevent the struggles of the insect; for by these struggles it injures itself, as well as its companions, after being pinned in the collecting-box.—*The American Entomologist and Botanist.*

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From June 4th to 11th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Domestic Goat (Capra hircus, ♀		Born in the Menagerie	Goat-sheds
1 Common Heron (Ardea cinerea)	Europe	Presented by Captain Salvin	Gull Pond
1 Martinique Water Hen (Porphyrio Martinicus)	Ditto	Purchased	Western Aviary
1 Common Rhea (Rhea Americana)	South America	Ditto	Emeu-sheds
1 Tuberculated Lizard (Iguana tuberculata)	St. Thomas	Ditto	Reptile-house.
1 Banded Woodpecker (Centurus tricolor)	South America	Ditto	Western Aviary
6 Short-nosed Sea-Horses (Hippocampus Brevirostris	European Seas	Received in exchange	Fish-house
15 Alpine Newts (Triton Alpestris)	France	Purchased	Ditto
25 Marbled Newts (Triton marmoratus)	Ditto	Ditto	Ditto
1 Bimaculated Sucker (Lepidogaster bimaculatus)	European Seas	Ditto	Ditto
1 Bliss-bok Antelope (Damalis albifrons)	South Africa	Deposited by E. O. Blake, Esq.	Eland-house
1 Solitary Thrush (Petrocincla cyanea)	Europe	Ditto Miss Forbes	Western Aviary

♂ Male. ♀ Female.

THE EFFECT OF POWERFUL MAGNETS ON MAN AND THE LOWER ANIMALS AND PLANTS.

BY JOHN VANSANT, M.D.,

Late Surgeon and Brevet Lieutenant-Colonel, U.S. Army, San Francisco.

IN THREE PARTS.—PART II.

EXPERIMENTS like the foregoing on growing plants seem plainly to prove that magnetism exerts an influence on their vitality. The shrivelling petals, the changing colour of the flower and leaves, the sudden emission of perfume, and the early decline of a delicate plant, point to the action of a subtle force affecting the molecular formation of the vegetable tissues. It cannot be thought that mechanical irritation by the slight touch of the steel could have been the cause of the phenomena; because, not to speak of the insufficiency of such an explanation, the same kind of effects, in a slighter degree, are produced when the magnet is approached very near to a plant or flower, but *does not touch it.* Heat could not have been the agent, since the instrument employed and the plants were almost exactly of the same temperature; and, moreover, *different* effects were produced by opposite ends of the same short magnetic bar applied at the same time.

Any apparent discrepancy in the recorded action of the same magnetic pole applied to corresponding parts of different plants is due, I think, to the different sensibility of the plants, and to the varying length of the magnetic application; but, however that may be, these experiments are not cited to prove the exact *differential* action of the poles of a magnet, nor were the observations recorded with sufficient minuteness for that purpose. They are simply intended to establish the fact that *a change* can be produced by the magnet in the intimate interstitial structure of vegetable tissue, without proposing to define precisely all the characteristics of that change. More attention has been given to the differential action of the opposite poles in my observations on human beings, as detailed further on in this paper. I select the following experiments on *animals* in continued illustration of the principle herein announced. These seem to me mostly very decisive, and I cannot help regarding the third one as an *experimentum crucis.*

Experiments upon the Lower Animals.—1. I took a small, vigorous earthworm (*Lumbricus terrestris*), and applied to it, alternately, the southward (+) and the northward (—) poles of a steel magnet 6 in. long, able to raise about one ounce with either pole. At first the worm appeared much stimulated, especially by the — pole, as indicated by its stretching itself out to its greatest length. The alternate gentle touches with the magnetic bar were then rapidly repeated, and in about three minutes the worm coiled itself closely, and *immediately died.*

2. I applied a well-magnetized horseshoe magnet, 3 in. long, and capable of sustaining about half a pound from its armature, to a small spider (*Aranea scenica*), so that the latter, placed without restraint between the two poles, could be rapidly, but carefully, touched by each in succession. In less than ten minutes after beginning this treatment the spider was dead.

3. (I extract the account of this experiment from my note-book, premising that the magnet employed was a good one, formed of a cylindrical steel rod, 11 in. long by one-fourth of an inch in diameter, with a wooden handle attached to the middle for convenience in manipulating.) "I killed another small spider to-day by the gentle application of a bar magnet. Quick touches with alternate poles on back seemed to affect it soonest. It was one hour from beginning of experiment till it died, though frequently I would wait six to ten minutes, after several rapid touches, and while it was lying motionless, to see whether or not it was dead. Then, by watching it carefully, with the aid of a large lens, I would see at first a tremulous motion of the extremity of one or more of its legs, as it lay upon its back with legs extended and directed upward. Then, in a few minutes, a sudden motion of perhaps one limb, and then, after another moment of rest, a spasmodic movement of

all the body, and it would throw itself again on its feet and rapidly run off as if nothing had happened. As the experiment progressed, the periods of sleep or stupor increased in length, and the spasmodic movements on awakening became less and less powerful, until toward the last it would have to make several attempts to turn over on its feet; and, sometimes, after it had turned over and made a step or two, it would suddenly throw itself again on its back, and lie motionless for several minutes. When it would revive from one of its attacks of stupor and run off, a touch or two of the end of the magnet would instantly put it again asleep on its back.

"The northward (—) pole seemed to have the most lasting effect upon it; though, at the very moment of application, the other pole, the southward (+), had the most stupefying influence; but from this latter it quickly recovered. I also think I observed that the application of the + pole to the back had the same effect as the — pole to the underneath part of its body, and stupefied it most. The contrary also seemed to be true, *i.e.*, the — pole to back, or the + pole to under part of body, affected it less permanently, but more quickly during the application.

"The way that seemed to stupefy it most of all was, after it went to sleep on its back, gently and quickly to roll it over with the — pole, thus touching its back and belly with the same pole in rapid succession. Finally, at the end of about one hour, it ceased to move at all, and did not again recover; though, before the last application of the — pole, it lay fully ten minutes without motion, and then so far revived as to be able to turn over and walk slowly off. In these touches not the least mechanical injury was done the spider; and I noticed that, towards the last, I could stop it when running off without actually bringing the magnet in contact with its body. Before employing the magnet in this experiment, I tried a brass rod of about the same size as the magnet, touching the spider in the same way; but this seemed to produce no effect upon it; it ran off just the same as before receiving the touches, and would pass over the end of the rod with impunity. I also renewed the trials with the brass rod at the end of about half an hour from beginning with the magnet, and when the spider was considerably enfeebled by the magnetism, but with the same negative effect as at first. The spider was a web-spinner, with a body about one-fourth of an inch long, and legs about half an inch; colour light brown, with a crescentic black mark on each side of thorax, and a lozenge-shaped mark in the centre of top of the abdominal section. This experiment was very conclusive."

4. With the — pole of the same magnet described in the last experiment I touched, as steadily as I could, for about two minutes, the head of a large-sized mouse. In a minute the animal, which was in a large glass jar, stood up and rubbed its head rapidly with its forepaws, ate ravenously of bread, then suddenly stopped and rubbed its head again, and licked itself all over in an excited manner. In four or five minutes it went to sleep, and could not be roused, by striking against the jar near its head, for about ten minutes. During this sleep I could lay the magnet on its head, and it would not move or open its eyes.

Then it awoke, fell again to eating hurriedly and rubbing its head, and in about five minutes went to sleep again for a short time. In twenty minutes afterwards I applied the same northward pole again to its head. On approach of the pole it raised its head and put its nose to the end of the magnet, gently touching and then slightly withdrawing it quickly many times for about a minute, when it passed into a stupor, remaining asleep with its front paws raised off the bottom of the jar; and in this position I rubbed its head with the magnet, without causing it to move. After a short time, say five minutes, it again awoke and repeated its eating, and head-rubbing with its paws. In fifteen minutes more I placed the + pole over the root of its tail. This also made it sleepy and stupid. Waiting then about an hour, I applied the + pole to its head about one minute. It kept still during the application, slept a minute, and then woke up to eat, but fell asleep while in the act of eating, and let the bread drop from its paws.

The application of the poles in succession and alone for periods varying from one minute to a half-hour produced only the same kind of symptoms, and failed to kill the animal in twenty-four hours.

At the end of this time I applied an induced current from an electro-magnetic machine, strong enough to be distinctly felt to the elbows in man, with the effect to greatly excite the creature and make it violently jump, but not to kill it, or seem to affect it after the application ceased, any more than the magnet did. Towards the last, the magnet—either pole—appeared only to excite and stimulate the animal, which would make great efforts to escape, sometimes seizing the end of the magnet in its mouth and jerking it quickly with all its might. But, earlier in the course of the experiment, the animal showed a preference for placing its head towards the northward end of the magnet, and its posterior part towards the southward pole; and if by chance it turned the hinder portion of its body toward the northward end, or its head towards the southward end, it would soon seem uneasy and change into the old position, when it would sit comparatively quiet for a considerable time. These last trials were made with one pole at a time, and also with two straight magnets at once, so that a reverse pole was on each side of the jar.

5. I applied, for about three seconds, the — (northward pole of the same magnetic rod used in the last two experiments to the vulva of a very small, healthy, female poodle-dog. In a few minutes the animal seemed stimulated and frisked about; then, after ten or fifteen minutes, licked the parts touched, as if to allay irritation there. At the end of half an hour the excitement was increased, as manifested by the staring and wild appearance of the eyes, the rapid motions and jumping when spoken to, and the slight spasmodic twitching of the muscles when the animal was sitting on its haunches.

After a few hours, as the dog slept, it seemed to dream, and gave frequent starts and uttered low cries; then trembled violently when awakened. Its whole body had a contracted look, and it was restless and little disposed to sleep. At the end of twenty-four hours its appetite was ravenous, and the excited condition continued, but with less intensity. About this time it had vomiting and then violent purging, and this state of things continued at least three days; still the animal did not appear very ill, and its appetite kept good; but a powerful impression had evidently been made on its nervous system.—*The (American) Journal of Psychological Medicine.*

A BOUQUET DISSECTED BY A BOTANIST.

LET us overhaul our bouquet. What have we got? Willows, birches, poplars "all a blowing and a growing," plane buds just showing their pink styles, primroses, wallflowers, flowering currants, Berberis, one sheet of golden bloom; maples, some in all the graceful beauty of inflorescence, others with the golden hue of new-born foliage; the Canadian Amelanchier, a sight to make the heart bound, so beautiful in its snowy flowers. Let no florist talk of "windmill petals;" let him see the snowy medlar in full bloom, and acknowledge that the windmill flowers are no disfigurement, The grape-pear is another not inappropriate name for this plant, for its flowers are like those of a pear (though, in truth, the latter are nearer to the florist's ideal), and arranged in grape-like clusters. How came it with such a name—Amelanchier? Books tell us that it is Savoyard for medlar. Indeed! but we should be grateful for more information as to this word. Perhaps some philologist will kindly tell us more about it. Are Hooker, Koch, and other botanists right in separating this from the pears? No one looking at the flowers would say so.

But then the fruit is ten, not five-celled, and that is a difference. There are several varieties, but we confess our inability to distinguish them, and stick to the two species, the one European, with the blunter leaf; the other European, with the pointed leaf.

What have we here, with flowers like a large double peach, and leaves like those of *Kerria japonica?* Surely it is a peach or an apricot? But how comes it with row after row of soft downy fruits in embryo, like eggs in a nest—apricots luxuriating in six or eight carpels instead of one? No doubt it is a Prunus "gone mad," as a satirical friend has it, though even he recognizes the rare beauty of the monster. No wonder the botanists were puzzled when they first saw it. Carrière called it *Amygdalopsis Lindleii*, not recognizing its exceptional character. But truly it is like an almond, while Lindley's name, *Prunus triloba*, though more correct generically, is far-fetched as to the specific name, for the leaves are not appreciably three-lobed. When we look into the flower and see one central carpel, and five subsidiary ones, each on a little stalk, we ask ourselves if it would be an advantage horticulturally to have six peaches instead of one from a single flower? The answer is, no; for reasons that any gardener will appreciate. When we ask ourselves, what if the additional carpels prove advantageous to the plant in some recondite manner, will they not be perpetuated through the agency of natural selection (see Darwin), and may we not have here the *fons et origo* of a new genus? If so, Carrière was only before the age when he established it as a new genus. On the other hand, what if pre-Adamite apricots and peaches had five or more carpels to each bloom, and this is a reversion to older conditions? Who can tell? The lake-dwellers in Switzerland had plums like our own to all appearance, but these prehistoric gentry are mushrooms compared with other inhabitants of this world more or less well known to the geologist. And now look at the flowers of this *Acer macrophyllum:* can anything be more exquisite than these full drooping flower-clusters, each flower a bell of perfect mould and with a filmy tuft of hairs around the stamens which art could not imitate. But that is not all. Nature made these things for a purpose; and wonderfully, thrice wonderfully, is everything adapted to the fulfilment of that purpose. See here the principle of the division of labour carried out, see there the care taken to insure the ripening of the seed and the perpetuation of strong healthy seedlings. In this particular plant the majority of the blossoms—those at the free end of the cluster—have stamens only, and these stamens protruding beyond their envelopes bursting with ripe pollen, as the bees full well appreciate, and each one clothed with the delicate cobweb-like hairs before alluded to. Look now at the very bottom of these flowers, and see the thick fleshy green disk trickling out its dewdrops of honeyed liquor. Do you wonder that messieurs the bees are at work here? What a feast for them! How they battle with the hairs which cover over the treasure! How thickly they get dusted over with pollen as they are rifling the honeyed store! Now look at the flowers near the base of the cluster, and notice that they are in groups of three, the central one the most vigorous, and bearing the young seed-vessel (a fact for Mr. Meehan, this; the female flower so placed as to receive the full flow of sap), the side attendant flowers similar to those at the end of the cluster. Examine now the central female flowers; there is the young seed-vessel, its stigmas all protruded, ready for messieurs the bees to alight on when weary of their labours in the pollen-bearing flowers. There are stamens here, too, around the young seed-vessel, but they are poor starvelings compared with the others; they are short, and do not protrude beyond the petals; their anthers are close, their pollen is not ripe, their stalks are less hairy than in the male flowers, and though there is a trace of disk at their base, the disk is dry as a chip: no honey there. It is clear that Nature does not intend these atomies to be the parents of the seedlings. The division of labour principle is acted on here, one flower is serviceable for pollen, the other for seed. What, then, is the meaning of the stamens in the female flower? Possibly they may be useful for other flowers, or if pollen from other flowers fall short; but more probably they are, as it were, relics of an earlier state of things, when the division of labour was not carried out as it is now; and when, instead of the influence of the pollen from one flower on the stigma of another being found requisite or preferable to insure the continuance of the species, fertilization was effected by the agency of the pollen on the stigma of the same flower. Physiologists tell us that this separation of the pollen element from the germ-producing structure is an advance, that a structurally perfect flower is in a physiological sense degenerate, and that a cross in some form or another is essential to the vigour and prolificacy of the species.

The other maples, of which there is a fine collection in the garden, show the same facts as those we have alluded to in the *Acer macrophyllum*. Let us hope that no one will think their beauty detracted from by this exposure of their life-history. To us the knowledge that each flower has its history written for us, if we would but read it, adds immensely to their interest. They become then to us as it were humanized. *We sympathise* with them; and wonderingly, and, we hope, reverentially, admire what before we merely looked at with more or less pleasure.

But our nosegay is not half exhausted. Here are Pavias, with leaves half expanded, and of the most delicate violet or mauve tints imaginable. Here is a double white peach, a glorious sight indeed, with its large dead-white blossoms. Here is the quaint Caragana, with its laburnum-like flowers and queer stunted "spurs," quite normal, not monstrous, though ugly enough to be so, were it not for the fact that the most beautiful of flowers in florist's eyes are monstrous! And here is a Ribes, or rather what we took for one, and hunted in vain through books and plates for its name, till at length light gleamed in on us, and we found we had a Rosaceous plant (*Nuttalia cerasiformis*) to deal with—very like a Ribes, very unlike a rose—not beautiful, certainly, but interesting; and when the wilderness is gone, where shall we go for a specimen of a Ribes-like rose? And here is another out-of-the-way Rosaceous plant—a Potentilla or a Geum, we think, as we look at its trailing habit and yellow flowers. Neither one nor the other, says the magnifying-glass, but a Walsteinia, as odd in its way as the Nuttalia, and much prettier; odd, because, with the appearance of a Potentilla, it has the structure, so far as the flower tube and carpels go, of an Alchemilla. But then we remember that roses and saxifrages are very multiform, and, though all tied together, yet including some curiously eccentric forms. Our bouquet is not a third overhauled, but the patience of the reader!—oh, reader! pray excuse "A Rambler," on a handful of flowers from Chiswick.—*Gardeners' Chronicle.*

MALAGASY VILLAGES.[1]

MALAGASY villages on level ground are generally monotonous and uninteresting enough. There is little to distinguish one house from another, and there is seldom much vegetation growing within the inclosure of the fosse to give the charm of verdure to the appearance of the place. In some villages the *Hàdy* is filled with lemon and peach trees, but these do not show much above the surface of the ground. In most villages there are several shallow square pits scattered here and there amongst the houses. These are called *Fahitra*, and are used to keep cattle in during the time of their being fattened. People have a notion that the animals thrive best if they stand during the feeding with the fore legs at a higher level, so as to throw the weight of the body on the hind quarters. Whether this is a mere fancy, or has any foundation in fact, it is undeniable that many animals attain a great size; but probably

[1] See Illustration on p. 527.

A MALAGASY VILLAGE.

their plentiful supplies of Indian corn, sugar-cane, and other food, has more to do with their excellent condition than their posture when feeding. The walls of many houses are covered with circular cakes of cow-dung drying in the sun. This fuel is chiefly used for heating the flat surfaces of rock from which the slabs used in making tombs are procured.—*Madagascar and its People.*

REVIEWS OF BOOKS.

A Handbook of Phrenology. By C. Donovan. London: Longmans. 1870.

We had thought—nay, we had hoped—that phrenology had met nearly the same fate as spirit-rapping, and had, with it, been consigned to the limbo of effete methods of *charlatanerie*. But we had hoped in vain. Here is a treatise, issued by the first publishing firm in the world, and written, the title-page tells us, by "C. Donovan, Professional Phrenologist, Doctor of Philosophy, and Fellow of the Ethnological Society." Whatever the scientific status of a "professed phrenologist" may be, we will not stop to inquire; but there can be no question as to the Doctor of Philosophy and the Fellowship of the Ethnological Society, a body of which Professor Huxley is the president. We cannot but express our astonishment, therefore, that a fellow of a society of such high standing as the Ethnological, could be found to compose a book full of the wild nonsense, the arrant absurdities, which the text of the work before us reveals in every page. It is throughout, from cover to cover, a tissue of the most unscientific dogmatism, without a single gleam of advanced anatomical or psychological fact or reasoning. So much good work has been done of late years in the investigation of both brain-structure and brain-function, that it would not have been too much to expect that a fellow of the Ethnological Society might at least have been expected to give us so much of a *resumé* as might have been picked up from the popular scientific periodicals. But when we find none of this, but in its stead an *olla podrida* of misplaced quotations from the poets, and a string of unsupported assertions, such as are to be found in the prospectus of every itinerant bump-feeler in the country, we may well ask if the Ethnological Society does not mean to take some steps to prevent its name being even indirectly associated with a work in every way so unworthy of modern science.

Dr. Donovan's philosophy—of which he claims to be a doctor—is surpassed by the purity of his English style and the exquisite good taste and extreme *suaviter in modo* of his preface. In the concluding lines of this composition he says:—"Phrenology has no rival theory. There is no other doctrine of mind and brain with which it can be compared. And so with opponents it is 'Hobson's choice'—that or nothing." Of the dignified and refined mode in which the author learned in philosophy discourses we shall say not a word; but we would just observe that, adopting the courteous expression of Dr. Donovan, and falling on the alternative he politely suggests, we should infinitely prefer the "nothing" to anything in the shape of the Boeotian philosophy which the "professed phrenologist" advances.

Observations on Fundamental Principles, and some existing Defects in National Education. By Neil Arnott, M.D., F.R.S., &c., Member of the Senate of the London University. London: Longmans. 1870.

Dr. Arnott's experience as a teacher, and as an exponent of the principles on which education should be conducted, entitles him to speak on the question he has now taken up with more or less of the influence of authority. We think, therefore, that it is to be regretted that, in the pages of the present work, he has not confined his attention to the consideration of some of those great problems which now occupy the minds of our leading *savants* and statesmen. Instead of doing this exclusively, Dr. Arnott has allowed his pen to wander from the proper limits of his subject, and has gone into the investigation of, or rather, the expression of individual opinions on, some abstract

[illegible] Lectures at the Royal Institution of Great Britain. [illegible] By John Tyndall, [illegible]. London: Longmans, [illegible]

DR. TYNDALL did not intend the work of his last year's lectures to appear further published than that they might form some being placed in the hands of the people: but, at the request of various persons, he has consented to issue them as a [illegible], and many manual, which will we doubt not, prove immensely popular with students of Physics. These lectures are, as the title implies, devoted to the subject of Light and its laws. They are arranged as a series of addresses, and may therefore reach the lowest readers of Optics that we have met for a long time. It is a book which we especially commend to the student, as it is brief, clear, accurate, and [illegible] easily learned.

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CORRESPONDENCE.

It is distinctly to be understood that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without reserve to any, and thus engage a channel for the publication of opinions of all shades.

We neither undertake to return rejected communications.

ALTERATIONS IN AND 2 URSÆ MAJORIS.—*From* H. MICHELL WHITLEY.

SIR,—In June 1868 Herr Schmidt wrote Mr. Birt, drawing attention to Argelander's and Bessel's [illegible] and Mädler show on their map as a crater nearly a mile in diameter, and describe it in "Der Mond" as the small crater [illegible] which shines with a light of 8°; Schmidt stated that this crater has now disappeared and a white spot occupied its place, and in this Mr. Birt confirms him.

I examined this region in the evening of June 8th, with a power of 250 on my silvered-glass reflector of 6½ aperture:—I found no crater of the size which Beer and Mädler show, but in its place a very conspicuous bright white spot of about 5" diameter and from 6° to 7° of brightness, closely resembling both in character and size, the white spot Lassell Beer and Mädler's little craterlet, south of δ, was plainly visible, and lay exactly on the edge of the white spot, and due south of its centre.

On a careful scrutiny I detected in the centre of the white spot a most minute craterlet or blowhole, not more than half the size of the craterlet mentioned above: this minute pit is not shown in Schmidt's drawing or mentioned by Mr. Birt as having been seen by him when he examined this spot in June 1868: and these observations, which are published in "The Student," vol. 2. p. 48, are the only ones I have met with.

It appears to me, then, that we have here a remarkable analogy to the case of Linné. Firstly, a well-defined crater is shown by Beer and Mädler; secondly, a white spot is now on the site of this crater; and, thirdly, the discovery of a minute pit in this white spot.

With regard to ξ Ursæ Majoris, the latest published measurement I have seen is one by Mr. Williams, of Liverpool. In the *Astronomical Register* for May, 1868, he gives "distance 1·85", epoch 1868·9;" it being, however, a binary star in rapid motion, the components are now closing up.

I divided it last night, with a power of 250 on 6½" aperture, and estimated the distance as being from 1 to 1.5".

Penarth, Truro, June 10th, 1870. H. MICHELL WHITLEY.

THE DOUBLE STAR ξ URSÆ MAJORIS.—*From* HERBERT INGALL.

SIR,—With reference to the inquiry of your correspondent respecting the double star ξ Ursæ Majoris, I beg to say that last night I examined the pair, and estimated the central distance at a little under 1·5".

It seems to me somewhat extraordinary that your correspondent should not see them divided with 4½ in. of aperture; perhaps he has not got his object-glass perfectly adjusted. The stars are finely separated in my telescope, which has an aperture of 5½ in., and a very fine correction. The power used was 750.

I am, Sir, yours obediently,

HERBERT INGALL.

1, *Champion-grove, Champion-hill, S.E., June* 11.

METEOROLOGY OF MAY, 1870.—*From the* REV. F. B. FALKNER.

SIR,—I beg to send you a few particulars of the weather of last month, as deduced from observations conducted by myself in this midland region.

The circumstances of atmospheric temperature and moisture refer to a stratum of air four feet from the ground.

The "solar" thermometer has its bulb blackened and inclosed in a vacuum glass chamber, and is 3½ ft. above the ground.

Another thermometer is freely exposed to the sky, and indicates the

lowest temperature to which unsheltered vegetation, near the earth's surface, is subjected in the course of the night.

The barometer is 335 ft. above sea-level.

I have the honour to remain, Sir, your obedient servant,

F. B. FALKNER.

Appleby Grammar School, Leicestershire, June 11.

METEOROLOGY OF MAY, 1870.

Mean maximum temperature of air	65·5°
Mean minimum temperature of air	41.4°
Mean diurnal range of temperature of air	24·1°
Highest temperature of air, on the 21st	79·5°
Lowest temperature of air, on the 3rd	31·4°
Total range of temperature of air	48·1°
Mean temperature of the air	53·9°
Mean temperature of a moist evaporating surface	49·3°
Mean temperature of the dew point	44·7°
Mean maximum reading of solar thermometer	114·6°
Highest reading of solar thermometer, on the 29th	129·0°
Mean minimum temperature of unsheltered vegetation	35·4°
Lowest temperature of unsheltered vegetation, on 7th and 10th	24·0°
Mean humidity of the air	·71°
Mean weight of water in a cubic foot of air	3·4 grains.
Mean height of the barometer	29·749 in.
Highest observed reading of barometer, on the 26th	30·140 in.
Lowest observed reading of barometer, on the 12th	29·050 in.
Observed range of the barometer	1·090 in.
Rainfall	0·750 in.

In the lower regions of the atmosphere, southerly winds blew twice as often as northerly; and westerly blew twice as often as easterly winds.

The drought still prevails in this neighbourhood, and there is no prospect of anything like an average grass-crop.

Only 6·1 inches of rain have fallen since the beginning of the year up to the present date.

There are often *threatenings* of rain, with dark clouds and a falling barometer; but generally only a change of wind takes place, the clouds disperse, and serene weather again sets in.

MR. PROCTOR'S "SATURN."—*From* R. A. PROCTOR, B.A., F.R.A.S.

SIR,—I should be hard to please, indeed, if your admission about Saturn did not satisfy me. Your note differed in one very marked respect from the altogether natural mistake you had fallen into. It was very new, indeed, to me to hear "Saturn" called a compilation; but it was nothing new to find the editor of SCIENTIFIC OPINION too generous and straightforward to be unwilling to withdraw an accidental misstatement.—Yours very truly,

RICHARD A. PROCTOR.

A LATE REPLY.

SIR,—I am not sure whether Dr. Ingleby is a reader of SCIENTIFIC OPINION. He lately made some comments in *Nature* upon views of mine respecting the Moon's apparent magnitude. I made a brief reply, conceiving that courtesy required it; the editor of *Nature* forgot, however, to insert my letter. Perhaps you will not mind letting this apology for apparent incivility appear in your correspondence columns. —Yours truly,

RICHARD A. PROCTOR.

MILITARY EDUCATION.

SIR,—It may have occurred to you that one of the topics of the day, namely, Military Education, as reported on by the Royal Commission appointed to inquire into its present state, has called forth but little expression of public opinion, whether scientific or otherwise. The professional notices in the military periodicals, the brief discussion in Parliament, and the few letters in the newspapers, have not exhausted all that may be usefully said of this Report—certainly not in relation to Natural Science, and Geology in particular, for which the Commissioners appear to have no interest; whilst, judging from a Royal Engineer's letter in the *Times*, criticising Sir J. Lubbock's speech in Parliament on the necessity of general scientific education in the Army, we may suppose that geological knowledge is neither exact nor extensive in the Scientific Corps, though it is invaluable to the military man, whether marching, camping, establishing forts, or building barracks. The form of ground, topography, or, more comprehensively, physical geography, means nothing without geology; the relative productiveness of routes and districts depends on geological structure and composition; drainage and water-supply are geological matters, and so are the supply and selection of building-materials, such as cements, mortar, slates, stones, bricks, and tiles; the nature of foundations, the making of earthworks and roads are ruled by geology, even when made by the dullest workmen by rule-of-thumb; fossil fuel and metallic and mineral substances, require in their finding and recognition geology, combined with mineralogy, as in the above-mentioned instances of the value of this knowledge, which comprehends, when complete, all branches of Physical Science.

If the erection of forts be determined on, they must, of course, be placed where military men require them; and their arbitrary position often makes their building costly and their water-supply difficult. But why should not their full cost be estimated at first? Why should their construction be carried on through a succession of mishaps and blunders? A western wall of the Vern Fort was built on the verge of flat Portland limestone, lying on sand and clay, and liable to be left unsupported by these soft beds when undermined by the waves of the Channel, as had often been the case before; and this the cliffs of the island show. Of course, the wall sank with the first slip of the limestone edge, and had to be reconstructed. For the great Portsdown Fort, a water-supply was, of course, indispensable; but why was money wasted in boring down a vertical fissure in *anticlinal* (sharply-arched) chalk beds after water, which must have run away, on one hand or the other, as soon as ever it filtered through the soil, after a shower, to supply the known springs and wells at Fareham and elsewhere? "R. E.'s" letter in the *Times* of April 12, states that "boring in chalk costs little money, and we have certainly obtained plenty of water in similar situations." Similar situations, or broken anticlinals, are not common in the chalk; and it would be wonderful if any engineer obtained any water in such a case. The Royal Engineer appears to consider that one boring in chalk is likely to be as good as another, just as any part of a sound cheese may be stabbed by the cheese-taster with equal results. So we have known a Civil Engineer impressed with the notion that blue clay could never be bored successfully for water, as he thought all blue clays were one to an indefinite depth, and had failed in his few trials, not knowing aught of the relative lie and thickness of the clays he had had to do with.

If, as "R. E." says, "boring in chalk costs little money," at least let the expenditure be made in proper situations; and if such well-known unfavourable circumstances attend the boring as any geologist must have anticipated for Portsdown, the public money might from the first have been appropriated for rain-tanks, or other water supply.

Look, again, at the unestimated cost of fort-building on bad foundations. Masses of brickwork were set on slippery clays in Hampshire,—then unbuilt, and subsequently reconstructed on an arched base. If this plan be right, after all, it could have been anticipated at first, the necessary expenses estimated, and waste avoided. So in the Isle of Wight, a bad system of drainage, made on anything but geological principles, for the site of a new fort, had to be undone at a great cost. This result might have been anticipated, but geological conditions were not taken into due consideration.

Sir John Lubbock stated that "when our army went to the Crimea, Sir R. Murchison applied to the Government to send out a geologist, but the request was not complied with." The newspaper report of Sir John's statement of the unfortunate position of the Commanding Engineer wanting water in the Crimea, and not knowing how to get it, is strikingly clear; and yet "R. E.," in the *Times*, appears not to have seen that, though Sir John Burgoyne did well to ask Sir Roderick about the matter, and to supply him with what information the young Officer of Engineers at hand could give, yet some one on the spot, well acquainted with geology and water supply, was what was needed; and such an expert Sir Roderick had urgently, but in vain, requested the authorities to provide.

After all, it is satisfactory to find that "R. E.," like every officer in the army who has given attention to Physical Science, fully sympathizes with Sir John Lubbock, in his effort to press on the Government the necessity of scientific education among Military Men. The French, Prussians, and Danes fight none the worse for being scientifically educated. Their scientific education begins in boyhood; and this is a matter of course under several European Governments, whilst English gentlemen, if it so please their parents and guardians, may vegetate with inactive minds, or cultivate one or two faculties in learning Latin and Greek in a slow, blundering, old-fashioned manner. But who dares to say that our Engineers and Artillery Officers fight the worse because they have devoted some years to the sciences and belong to the Scientific Corps? Are the present generation of scientific Staff Officers wanting in soldierly spirit? Are the thousand and more Cadets who have of late years studied Natural Science wanting in pluck and gallantry, though they have had an improved intellectual training? Nay, their bravery has been proved; and they possess additional accomplishments, which do not trench on the mental work required by any military study or pursuit—which will help them and others at need, and be always at command to enliven a dull station or weary route.

The Commission, as well as "R. E.," asks for "practical science,"

and dreads the effects of "cramming." *Vivâ voce* examinations meet the latter, sound elementary instruction only can produce the former. The Royal Commissioners on Military Education, and others, seem to think that the practical results of Science can be got at without elementary teaching,—as if "practical geology" were an art to be taught at an hour's notice to a Military Surveyor, for instance, wishing to show his pupils how to seize and apply the geological features of a country,—or as if even Sir Roderick Murchison could tell the Crimean Army by letter where they might strike the rocks for water!

The above-mentioned points, and much else having reference to a liberal and useful education of Military Officers, would have been well worth the consideration of the Royal Commission, even though its members comprise no one devoted to, or eminent in, the Natural and Experimental Sciences.

I am, Sir, yours truly,

T. R. J.

SCIENTIFIC SOCIETIES.

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

ETHNOLOGICAL SOCIETY.

JUNE 7TH.—Special meeting at the Museum of Practical Geology, Dr. A. Campbell, V.P., in the chair.—R. H. Tiddeman, Esq., B.A., F.G.S., was announced as a new member.

Professor Huxley, LL.D., F.R.S., president, read a paper "On the Chief Modifications of Mankind and their Geographical Distribution." After explaining the chief physical characters by which the several modifications are distinguished—such as colour, character of hair, and form of skull—the author described five distinct types of mankind:—The Australioid, found in Australia, the Dekhan, and the valley of the Nile; the Negroid, including the Negroes and Bushmen of Africa, and the Negritos of New Guinea, Tasmania, &c.; the Zanthochroic, distributed through Iceland, Eastern Britain, Scandinavia, North and Central Germany, through Eastern Europe into Asia, as far as North-western India, and found also in North Africa; the Melanochroic, situated between the Xanthochroic and Australioid peoples; and the Mongoloid, a large and somewhat ill-defined group occupying Central Asia, the two Americas, and Polynesia. The paper gave rise to a discussion, which was sustained by Mr. George Campbell, Mr. Wallace, Dr. Ray, Mr. Luke Burke, Mr. Dendy, Mr. Squier, and others.

At the same meeting Mr. E. G. Squier exhibited a large collection of drawings, plans, and photographs of localities of interest in Peru.

ENTOMOLOGICAL SOCIETY OF LONDON.

A. R. WALLACE, Esq., president, in the chair.—Mr. F. V. Jacques, of Bristol, was elected a member.

Exhibitions were made by Mr. McLachlan, Mr. S. Stevens, Mr. Albert Müller, Mr. W. Warwick King, Major Munn, and the Secretary.

Communications were made by Major Munn, "On the Honey-bee;" by Mr. A. G. Butler, "On the possible identity of *Argynnis Niobe* with *A. Adippe*;" and by Mr. G. R. Crotch, "On the Genera of *Coleoptera*, studied chronologically" (second part, 1802 to 1821).

AERONAUTICAL SOCIETY.

AT a meeting of this society, held at the Society of Arts on Friday evening, June 3rd, Mr. Glaisher, F.R.S., in the chair, several papers were read and illustrated by models.

An instrument for ascertaining the connection between velocity and pressure, exhibited by Dr. Smyth, of Maidstone, procured the encomiums of the chairman, who stated that it was calculated to supply information that was wanting in the instrument which he had been using..

In the course of discussion, Mr. A. Stewart Harrison strongly advocated the necessity of an experimental period, whereupon the chairman asked Mr. Fred. W. Brearey, the honorary secretary, to read an extract from the minutes of a late council meeting held at Stafford House, at which were present Mr. Glaisher (in the chair), Sir William Fairbairn, Bart., Mr. Brooke, Mr. Wright, Mr. Wenham, Mr. Ehren, and Mr. Brearey (hon. sec.), as follows:—"Sir Wm. Fairbairn observed that we know but little of the reaction or lifting power of various forms of screw blades in the atmosphere relative to the force employed, though such experiments might be easily tried and the data obtained. Mr. Brooke was of opinion that, if a successful aerial machine was to be constructed, the most simple and obvious plan was that of inclined surfaces impelled forward horizontally. The most successful experiment that he had ever witnessed was upon this principle, the motive power being a wound-up clock-spring, which, as long as the power lasted, sustained the machine; and further, that most large birds were capable, during long periods of their flight, of sustaining themselves exactly in this way. It was further remarked that we were practically ignorant of the correct laws of the sustaining power of inclined surfaces of different forms and areas; and this want of knowledge was a perpetual stumbling-block to those who were willing to spend time and money in experiments. From the fact that as the weight and size of birds increased, so did the relative wing area decrease, it would appear that the ratio of sustaining surface to weight or resistance was by no means in equal proportions. The chairman stated that, with respect to plane surfaces of various figures exposed to the direct impact of the wind, he had already been trying some experiments with such instruments as were at his disposal, and that by employing two anemometers at the same time, so as to be sure of comparative results, he found that the indication of force increased with the size of the surface, also in the two instruments, equal surfaces shaped into different contours, gave different results. These interesting experiments, so directly bearing upon the question of ærial propulsion and resistance, were still occupying his attention, but at present he could tell us nothing from actual experiment of the resistance of inclined surfaces of various forms. It was then proposed that an experimental fund should be raised by subscription, and that a suitable and well-finished anemometer should be constructed, having the means of instantly setting various plane surfaces at any desired angle, and capable of registering both horizontal and vertical force simultaneously for all degrees of inclination. The results to be published for the benefit of the Society."

Upon this proposition being put to the meeting, it was carried unanimously.

LINNEAN SOCIETY.

JUNE 2ND.—G. Bentham, Esq., president, in the chair. The Rev. T. A. Marshall was elected a Fellow. The president nominated J. J. Bennett, Esq.; G. Busk, Esq.; Dr. J. D. Hooker, and W. W. Saunders, Esq., vice-presidents for the ensuing year.

The following papers were read:—

"On some New Forms of Extra-European Trichopterous Insects," by Mr. R. Maclachlan; and "New Lichens recently discovered in Great Britain," by the Rev. J. M. Crombie.

Professor Bell exhibited a flowering specimen of the wild tulip (*Tulipa sylvestris*, *L.*), of which a patch, of about 3 ft. in diameter, occurs in the park at Selborne, Hants. In a note to the librarian, which accompanied the specimen, Mr. Bell states that the plant is undoubtedly wild there, and that it also occurs in two other localities within a few miles of Selborne; viz., at Froyle, and near Theodore Grange, Alton.

Mr. D. Hanbury exhibited the dried fruits of two species of Zizyphus, called by the European residents in China red and black dates. These fruits are used by the Chinese as articles of food, and are exported in large quantities from the city of Chee Foo. The red dates appear to be identical with the jujubes of the South of Europe.

GEOLOGIST'S ASSOCIATION.

JUNE 3.—Professor Morris in the chair.—A very *interesting* and instructive paper was read by C. T. Richardson, M.D., the result of a hurried visit to Cornwall, the Land's End, and the Scilly Isles, on the Physical Features and Geology of those districts.

In the early portion of his address, the author pointed out the remarkable facilities which now existed for becoming practically acquainted with the general history of the geology of the western districts of Devon and of the whole promontory of Cornwall, as the result of the high level at which the West Cornwall Railway was compelled to be made, in order to cross the valley at Ivy Bridge, and also carried over the wide sinuous bay at Saltash, by which a very accurate general idea of the characters of the whole district may be obtained from the *coup d'œil* presented, even during the hurried passage of the train on its route to Penzance. Running as it does through some of the principal districts, furnishing both tin and copper, many of the facts connected therewith may be readily gathered, and some idea formed of the extent of area over which these minerals are developed, and also of the districts where the occurrence and preparation are to be seen of the interesting material known as *Kaolin*, or China clay, the basis or essential element in the manufacture of our improved porcelains or keramic ware.

The author described successively in detail the several prominent features of the district—the serrated and sinuous coasts on both shores, with their lofty and precipitous rocky cliffs; the general high table-land, as it were, of the whole peninsula denuded and eroded into deep and numerous valleys constituting the well-known hilly character of the country; the great divisions and different nature of the rocks

forming the bulk of the district; the granitic, and the schistose, and the different features each gives to the aspect of the country; the isolated developments of granite at Dartmoor, Templemoor, Redruth, St. Austell's, St. Michael's Mount, the Land's End, and Scilly Isles, with all the rocky fragments fringing the coasts at greater and less distances, as at the Longalips, the Wolf Rocks, and the Eddystone.

The conclusions sought to be conveyed by the author were, that Cornwall, as at present existing, was but the remnant of a former great and vast area extending seawards to the south and west, continuous with Scilly and the more distant similar rocks on the coast of Brittany; that this continuity was interrupted by some correspondingly extensive and powerful cause, operating, in all probability, as may be gathered from a consideration of the history of Dartmoor, at or about the period of the close of the Carboniferous era; that the Scilly Isles formed a part of the line of fracture, and were the advanced headland of Cornwall, as does the Land's End now form the extremity of a similar coast line traceable through the Wolf Rocks to the Eddystone, and still further eastwards.

In conclusion, the author impressed with earnestness the necessity for students, at the outset of their studies, visiting such scenes as the Land's End, in order, as early as possible, to acquaint themselves with the visible and acting operations of nature on a large scale, so as to be able to form a somewhat proximate idea of the extent of area over which her influences are exerted, and endeavour to estimate the power and might with which her never-ending forces are felt. In proposing the thanks of the Association to the author, Professor Morris pointed out the several points suggested by the author which might well admit of extensive discussion, and supplemented most interesting details bearing upon the subject, in relation more especially to the mineral productions of tin and copper, the modes and variations in their occurrence, as well as to that of China clay. Specimens of several of the varieties of granite from St. Mary's, Scilly, and the neighbourhood of the Land's End, were exhibited, presenting many of the well-known characteristic variations of chemical and mineral composition, and elicited very instructive demonstrations; as did also a quantity of sand from Porthcurno Bay, the material forming the artificial soil in which is raised the enormous quantity of early cauliflowers and potatoes sent to our London markets, it being composed principally of the felthspathic materials of the granite and the comminute remains of marine shells.

The author recommended the Scilly Isles as being well worthy a visit to all natural-history students, as possessing much interest; the access being very easy, a mail steam packet sailing from Penzance three days a week, and from Scilly on alternate days, the passage occupying four hours; and very good accommodation being to be met with at the hotel.

SUNDAY LECTURE SOCIETY.

ST. GEORGE'S HALL, LANGHAM-PLACE.—On Sunday evening last, W. B. Hodgson, Esq., LL.D., lectured on "The Writings of Turgot." This truly meritorious French reformer engaged himself strenuously, for some years immediately previous to the Revolution, in behalf of the people, the lower classes of whom were, at that time, in a most deplorable condition. By reason of his assiduous labours, physical and mental, he enfeebled his bodily powers, and this only to be hated by those in power—a power wielded to the disadvantage of the classes he sought to protect. In speaking of Turgot's writings, the lecturer confined himself to those the subjects of which were most closely connected with his life as a statesman and as an orator. There came from his pen much that was then new, but which is now looked upon as mere matter of fact. At times, one knows not whether most to admire the originality of his views, or to acknowledge the manner in which they have made their way in our time. A large number of quotations from the writings of Turgot tended to show the almost endless diversity with which he wrote, and the general correctness and truthfulness of the whole. "A society exists," he said, "for individuals: it is constituted to accomplish the rights of all." "Law is authoritative when based on justice." The right to labour was one of the great truths upon which Turgot insisted. "God, by creating man with hands, has made the right to labour the property of every one. We regard it as one of the acts most worthy of our beneficence." Such were the words which he put into the mouth of his one-time kindly-disposed master, Louis XVI. Turgot was no believer in the gospel of tied hands; and it is almost superfluous to say that he considered the state of slavery to be the worst state of humanity, and serfdom next to it. "Property is nothing more than the free disposal of what we possess legitimately." Conquest he held to confer no lasting or solid right. He did not even admit the power to bequeath by will without important distinctions. There is every reason to presume that a bequest or foundation, no matter how good in intention, may one day become useless. Turgot long prophesied the good to be derived by the separation of the American Colonies from the Mother Country. His principles with regard to trade in corn and other produce, were absolute freedom from restrictions of any kind. Dr. Hodgson frequently elicited the hearty applause of his hearers, both from the piquancy of his style of delivery, and on account of the evident justness with which he delineated the character of a worthy man by his writings—the undoubted benefactor of his country—the friend, in no small degree, of his kind.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

THE following papers have been read at the meetings of the Society, held during May, in the Midland Institute:—

On the 3rd inst. Mr. H. S. Scollick read a paper on "A Day's Collecting at Lulworth, Dorsetshire." Mr. Scollick gave an interesting account of a day spent in this locality in August, 1869, in search of Lepidoptera, some of the rarer species of which are there met with in great abundance on the chalk hills which slope down to the sea. The following were among the species obtained:—*Colias edusa* (the clouded yellow), an insect much prized by collectors; it occurs in some years in great abundance, but in others, from causes which have yet to be explained, it is very rare. *Arge galathea* (the marbled white); this somewhat local species was met with, abundantly flying over a narrow strip of ground about a mile in length. *Polyommatus corydon* (the Chalk Hill blue), apparently not so common at Lulworth as in other chalk districts. *Pamphilus actæon* (the Lulworth skipper); this insect is highly prized by collectors from its rarity, and not from any beauty that it possesses. It is said to have been taken only in three or four localities in England. At Lulworth Mr. Scollick met with it in the greatest profusion. The paper was illustrated by a beautiful collection of insects captured during the day above mentioned. In conclusion, Mr. Scollick observed that he believed the botanist would find that locality as rich in objects of his research as he had in entomology.

On the 10th inst. Mr. James Lancaster read a paper entitled "The Eye Piece examined and discussed." In commencing he stated that he intended to treat only of the action of the different eye pieces upon the rays received from the object lens, omitting all reference to the refractive and dispersive power of the glass best adapted for eye pieces, and to the various kinds of lenses used, and the principles involved in their arrangement for correcting chromatic and spherical aberration; the various eye pieces now used by the first makers of microscopes, and the advantages and actions of each were clearly described. Mr. Lancaster offered some practical hints on the manipulation of the microscope, which excited considerable interest among the members of the microscopical section.

On the 17th inst. a paper was read by the Rev. H. W. Crosskey, entitled "Notes on the Post-Tertiary of Norway." The paper described observations made in the neighbourhood of Christiania, and various islands in the fjord. The writer had also visited Skien, on the north-west of the fjord, entered the Thelmakeen district, visiting the Gousta mountain, and the waterfall of the Ejukampos, returning to Christiania by Konsberg and Drammen. In the course of this route typical beds belonging to various parts of the Norwegian post-tertiary series were examined. The physical signs of ice action over this district, during the period when North Britain was in the condition of Greenland, were pointed out. The boulder clay of Norway is analogous to that of Scotland, having the same general characters resting upon the grooved and polished rocks. A large number of sands and clays occur containing Arctic shells, indicative of an extreme degree of cold. The fauna contained in these beds is well developed, and slightly more Arctic than the fossil fauna of the British glacial clays. The shells in the clays of this part of Norway are more Arctic in character than the shells found living off the coast. There is a greater difference, however, between the living British shells and the fossils in our clays than between the Norwegian living shells and the fossils The change of climate has been greater in Britain than in Norway. During the glacial epoch, the south-west of Norway was much colder than at the present; and North Britain experienced nearly the same degree of cold. Succeeding the extremely Arctic beds, a series of clays and sands occur, containing shells marking the amelioration of the climate and the elevation of the present land surface. The change took place gradually, and is marked by specially characteristic shells. In the island of Barholmen a sandy clay is found reaching the height of 100 feet. In this bed *Oculina prolifera* is abundant, a coral now found living at a depth of 150 to 300 fathoms. The shallowest depth which can be assigned the living coral thus marks an elevation of the land of 550 feet. The coral is associated with shells characteristic of very deep water, and belonging to the Finmark fauna. The fauna does not belong to the extreme glacial epoch, but marks deep sea conditions, with the temperature off Finmark, in the present fjord of Christiania. In beds near Skien a few Arctic shells linger with a large increase of species now found on the coast, denoting the gradual approach of the present climate. A collection of specimens from a series of beds was exhibited and described, and the paper concluded by referring to the

large problems in physical geology involved in the right interpretation of the post-tertiary beds.

On the 24th inst. Mr. W. R. Hughes exhibited, and gave a brief account of, a new coral recently obtained by Mr. G. H. King, London, from the coast of France. Mr. Hughes observed that those persons who are familiar only with the large tropical specimens, brought to this country as curiosities, have but little notion of what the appearance really is when invested with the gelatinous portion of the animals, which when expanded forms a beautiful star-like object of various and gorgeous colours. The animal itself is an Actinoid polyp, having the usual fringe of tentacles on the margin of disk, the centre of which is occupied by the mouth, opening direct into the stomach. The earthy matter which forms the base or corallum is calcareous, and secreted in a variety of forms, having more or less of a radiate character; the laminæ or plates which are set vertically being of delicate structure and arranged in cycles. The new species is very richly coloured, being scarlet and yellow; it belongs to the genus Paracyathus, and has recently been described by Mr. P. H. Gosse, though "with some measure of reserve," under the name of *P. nobilis*. Dr. James Hinds read a paper entitled "The Anatomy of Birds and Mammals compared." He commenced by showing in what way these two large orders of the animal kingdom resembled each other, and then, having referred to their classification, proceeded to point out some of the distinctions between them, such as might be seen in the occipital condyle, the articulation of the jaws, the attachment of the head to the spinal column, the absence of mammary glands in birds, and the difference of their blood corpuscles, &c. The skeleton of birds was described, and the various parts still further elucidated by means of anatomical preparations. Dr. James Hinds concluded a very interesting and instructive paper by expressing his intention of continuing the subject on a future occasion.

On the 31st inst. Mr. C. J. Woodward, B.Sc., read a paper "On Light in relation to Optical Instruments." He commenced by observing that, in order to understand the manner in which light is propagated, the transmission of force by waves must be understood, and especially the transmission of vibration by the atmosphere. According to the accepted hypothesis, light is propagated in a manner analogous to that of sound. The medium, ether, receiving the pulsations of a luminous body, transfers them to the retina of the eye, and thus produces in us the sensation of light. The ether waves are themselves invisible; a so-called beam of light being invisible except there be haze or dust to intercept it. The constitution of a luminous body, as an assemblage of luminous points, was explained and illustrated. The law of inverse squares, and its application in determining the relative brightness of two lights, was illustrated by several experiments. A statement of the laws governing the reflection of light concluded the paper, which, as Mr. Woodward explained, was an introductory one. Thanks were unanimously voted to Mr. Woodward, who, in making his acknowledgements, stated that he was largely indebted to Mr. Cresswell for assistance in the preparation of the illustrations.—Mr. T. Fiddian submitted a very rare and curious work entitled "Oculus Artificialis Teledioptricus," &c., published at Nuremberg, in 1702, by Jean Zahn, containing numerous curious aphorisms, and a description of many compound microscopes—amongst others two binocular ones, and also a figure of the microscope of Francis Grindelius, constructed to exhibit opaque objects; the optical part consisting of six plano-convex lenses. No mention is made of the size of this instrument. Mr. J. G. Grenfell exhibited beautiful specimens of Euplectella and Hylonema dredged off the coast of Japan; Dr. W. Hinds, a number of ferns from Llanfairfechan; Mr. W. G. Blatch, a number of Araneidæ and Lepidoptera; and Mr. W. Nelson, *Zonites glaber*, a species recently added to our British Fauna by Mr. Thomas Rogers, of Manchester, who discovered it under stones in Marple Wood, Cheshire. It is described by Mr. Gwyn Jeffreys in the *Annals and Magazine of Natural History* for last month. Dr. Norris made some very interesting remarks upon the subject of catalepsy, showing that whilst it is of very rare occurrence in the human subject, in some of the lower animals, as in the *Anguis fragilis*, it is a normal condition.—The Secretary stated that the programme for next quarter was not filled up, and that he should be glad if members would give in their names for papers.

TORQUAY NATURAL HISTORY SOCIETY.

The annual general meeting of the members was held at the Museum, at 8 p.m. on Wednesday, the 25th of May; Dr. Paget Blake, president, in the chair. The honorary secretary read the following reports:—

"In presenting their report for the official year, 1869-70, the committee have the pleasure of congratulating the members on the continued prosperity of the society. The lectures during the session just closed have been very largely attended, the visitors to the Museum have been unusually numerous, several donations of great value have been received, the number of new members has exceeded that in any previous year, and, as will be seen by the annexed financial statement, a considerable addition has been made to the balance in the treasurer's hand.

"*Obituary.*—They have, however, the painful duty of recording the decease of three members of the society during the past year:—Mr. Jonathan Couch, F.L.S., Corr. Memb. Z.S., &c., who was elected an honorary member of the society on the 2nd of April, 1845, died at his native place, Polperro, in East Cornwall, on the 13th of April, 1870, in the eighty-second year of his age. He was distinguished by his knowledge of natural history generally, and very eminent as an ichthyologist. He was the author of many papers read to the various scientific societies in London and Cornwall, and a frequent contributor to the scientific journals. He largely assisted Bewick in his projected *Natural History of British Fishes*, and Yarrell in his *British Ichthyology*; and he edited an annotated translation of *Pliny's Natural History*. The following is a list of his principal independent works:—*The Cornish Fauna, A Treatise on the Natural History of the Pilchard, Illustrations of Instinct deduced from the Habits of British Animals*, and *A History of the Fishes of the British Islands*, in four volumes, illustrated with 250 portraits, drawn and coloured by the author.

"Dr. P. Lovell Phillips, F.R.C.P.L., was one of the foundation members of the society, and in various ways rendered it very valuable aid. He was a member of the committee during the first two years of the society's existence; he took an active part in the arrangements for the lectures in 1844-5, when he delivered a course of three on *Organic Chemistry*; and from time to time he enriched the Museum by presents of fossils from Kent's Cavern, purchased at the sale of the late Rev. J. MacEnery's collection. Dr. Phillips was the author of *The Principles of Agriculture, especially tropical, and of Organic Chemistry, familiarly treated*; and on several occasions he printed in the local journals a series of letters descriptive of his travels in the West Indies and in Continental Europe. He died on 2nd July, 1869, at Exeter, whither he had gone for change of air.

"The Rev. Dr. Pitcairn was elected a member of the society on the 15th November, 1844—about six weeks after it was established. Though his tastes and his profession led him to Divinity as the great study of his life, he was much interested in the progress of science, and especially in its connections with theology. He appeared before the society as a lecturer in December, 1867, when he delivered a course of four lectures *On Biblical Testimonies to the Antiquity of the Earth*, in which he not only accepted the conclusions of geologists respecting the age of our planet, but contended that they were distinctly taught in various parts of the Bible. The lectures were subsequently published as an independent work, under the additional title of *The Ages of the Earth*." Dr. Pitcairn was a vice-president of the society during the year 1866-7. He died at Torquay, on January 4th, 1870, at the age of eighty-one years.

"*Members.*—During the year 1869-70, seventeen new members have been elected. At present the society consists of a total of 104 members, exclusive of five subscribers for periods less than a year.

"*Library.*—The following works have been added to the society's library:—I. Presented by the authors—'Curiosities of Salmon Life,' by Dr. C. P. Blake, president of the society. 'The Preservation of Health in Individuals and Communities' (Ibid.). 'On the Older Rocks of South Devon and East Cornwall,' by H. B. Holl, M.D., F.G.S. 'Dry Closets *v.* Water Closets,' by Dr. Lombe. 'A Classified Index to the Transactions, &c., of the Geological Society of London,' second edition, by G. W. Ormerod, Esq., M.A., F.G.S., Hon. Member of the Society. 'Geological Proofs of Divine Action,' by S. R. Pattison, F.G.S., Hon. Member of the Society. 'On the alleged Occurrence of *Hippopotamus Major* and *Machairodus latidens* in Kent's Cavern, Torquay,' by W. Pengelly, F.R.S., &c. 'The Literature of Kent's Cavern, part 2, including the whole of the late Rev. J. MacEnery's MSS.' (Ibid.) 'Report of Two Lectures on the Ancient Cave-men of Devon' (Ibid.). 'On the Rainfall in Devonshire during 1868' (Ibid.). 'The Rainfall on the St. Mary Church-road, Torquay, during the five years ending December 31, 1868' (Ibid.) 'On the Submerged Forest at Blackpool, near Dartmouth, South Devon' (Ibid.). 'The French Imperial School of Forestry,' by A. Pengelly, B.A. 'The Chemistry of Sewage,' by E. Smith, F.C.S. 'The Noachian Deluge,' by T. R. R. Stebbing, M.A. 'Science and Revelation,' by G. A. F. Wilks, M.D. 'On the Effects of a Recent Wind on the Evergreens of Torquay' (Ibid.). II. Presented by societies, &c.—'Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art (1869).' III. Presented by the publishers—'Scientific Opinion,' vols. 1 and 2. IV. Presented by Miss Burdett Coutts—'Underground Life; or, Mines and Miners,' by L. Simonin; translated, adapted to the present state of Mining, and edited by H. W. Bristow, F.R.S. (1869). 'The Mineral Kingdom,' by Dr. J. G. Kurr. V. Presented by the Subscribers to the Fund for the Reception of the Members of the British Association at Torquay in 1869—'The Encyclopædia Britannica,' eighth edition, 21 vols. 'Reports of the British Association, from 1831 to 1869 inclusive,' 38 vols. VI. Presented by Messrs. Gardner & Greenfield—Thirty-eight Plates of Fossils, from Kent's Cavern, &c. VII. Presented by Mr. G. E. Hearder—An extensive File of the *Times* newspaper. VIII. Presented by Mr. A. B. Sheppard—

'The Last Report of the Committee for Dredging among the Shetland Isles.' 'Anti-Darwinism,' by the Rev. Jas. McCann, D.D. IX. Presented by Mr. E. B. Tawney, F.G.S.—'Huxley's Introduction to the Classification of Animals.' 'Griffin's Crystallography.' X. Presented by Rev. H. H. Winwood, M.A., F.G.S.—'Proceedings of the Bath Natural History Society and Antiquarian Field Club,' No. 3, 1869. XI. From the Palæontographical Society (issued for 1869)—'A Monograph of the British Fossil Corals,' Second Series, by P. M. Duncan, M.B., Lond. F.R.S., F.G.S., Part 2, No. 2. 'A Monograph on the British Fossil Echinodermata from the Cretaceous Formation,' by T. Wright, M.D., F.R.S., Edin., F.G.S., Vol. 1, Part 3, on the Diadmadæ. 'A Monograph of the British Belemnitidæ,' by J. Phillips, M.A., LL.D., D.C.L., F.R.S., F.G.S., Part 5. 'A Monograph of Fishes of the Old Red Sandstone of Britain,' Part 1 (concluded). The Cephalaspidæ, by E. Ray Lankester, B.A. 'A Monograph on the Fossil Reptilia of the Liassic Formations,' by Professor Owen, F.R.S., D.C.L., Part 2, Pterosauria. 'A Monograph on the British Fossil Cetacea from the Red Crags,' by Professor Owen, F.R.S., D.C.L., No. 1 containing Genus Ziphius. XII. From the Ray Society (issued for 1868)—'Vegetable Teratology,' by Maxwell T. Masters, M.M., F.L.S. XIII. Purchased—'A History of the British Sessile-eyed Crustacea,' by L. Spence Bate, F.R.S., F.L.S., &c., and J. O. Westwood, M.A., F.L.S., 2 vols. 'A History of the British Hydroid Zoophytes.' by T. Hincks, B.A., 2 vols. 'The Malay Archipelago,' by A. R. Wallace, 2 vols. 'The Year Book of Facts,' for 1869 and 1870, 2 vols. 'Spectrum Analysis,' by Professor Roscoe. 'Outlines of Astronomy, 10th ed., 1869, by Sir J. F. W. Herschel. 'Reliquiæ Aquitanicæ,' Part 10, by E. Lartet and H. Christy. The following periodicals are regularly taken by the society:—*Quarterly Journal of the Geological Society; Quarterly Journal of Science; Popular Science Review; London, Dublin, and Edinburgh Philosophical Magazine; Annals and Magazine of Natural History; Zoologist; Geological Magazine; Athenæum; Nature; Notes and Queries;* and *Scientific Opinion.*

"*Museum.*—The following objects have been presented to the Society's Museum:—1. By the Baron A. de Hügel:—A great bat, *Vespertilio noctula;* a Barbastelle bat, *V. Barbastellus;* a Lesser long-eared bat, *V. brevimanus;* a long-tailed duck, *Anas glacialis,* adult, full plumage; a black guillemot, *Uria grylle;* summer plumage; an arctic tern, *Sterna arctica;* adult, full plumage; a fox shark, *Cacharius vulpes;* a Ballan wrass, *Labratus maculatus;* a dog-fish, *Galeus acanthias gaea;* a fishing-frog, *Lophius piscatorius.* 2. By Mr. J. C. Hele:—A skull of a badger, *Meles taxus.* 3. By Mr. W. Vicary, F.G.S., hon. member of the Society:—Fossil shells from the Greensand of Haldon. In accordance with a resolution of the committee, all holders of tickets for the meeting of the British Association at Exeter were admitted free to the Society's Museum and Library during August, 1869, and large numbers availed themselves of the privilege. It may be added that, in addition to these, the number of visitors who paid at the door was larger than in any month since the Museum was first established.

"*Lectures.*—The following lectures were delivered at noon on Mondays during the session, which commenced on November 1, 1869, and closed on April 25, 1870:—Dr. C. P. Blake, one, 'The Presidential Address,' and one, 'A Scamper through Cornwall.' Rev. W. Dawson, M.A., one, 'Philosophy *versus* Science in History.' Rev. Preb. Harris, M.A., one, 'Art Education.' Mr. Pengelly, F.R.S., four, 'The Moon;' one, 'The British Association at Exeter;' one, 'The Devonshire Association at Dartmouth;' one, 'The Progress of Science in 1869;' and twelve, 'The Geology of Devonshire.' Rev. T. R. R. Stebbing, M.A., one, 'The Noachian Deluge.' Mr. E. Tawney, F.G.S., one, 'Spectrum Analysis.' Mr. Vivian, M.A., one, "Art Education.'

"*Monthly Meetings.*—The Monthly Meetings of the Members have been regularly held at 8 p.m. on the second Wednesday of every month during the year. The following is a list of the communications which have been read:—

June 9th, 1869.—'Notes and Queries on Salmon,' by Dr. C. P. Blake. July 14th.—'The Literature of Kent's Cavern, Part II.,' by W. Pengelly, F.R.S. August 11th.—'On the alleged occurrence of *Hippopotamus Major* and *Machairodus latidens* in Kent's Cavern,' (*Ibid*). September 8th.—'The Fifth Report of the Committee for exploring Kent's Cavern,' The Committee. October 13th.—'On the Meteorology of Torquay and Bournemouth,' and on 'Some New Self-registering Hygrometers,' by Mr. Vivian, M.A., F.M.S. November 10th.—'The Ancient Cave Men of Devonshire,' by Mr. Pengelly. December 8th.—'On Drainage, with special reference to the Dry Earth System,' by Dr. C. P. Blake. 'On the Chemistry of Sewage,' by Mr. E. Smith, F.C.S. (communicated by the President). 'On the Removal and Disposal of Town Sewage,' by Mr. E. Appleton, F.I.B.A. (communicated by the Hon Secretary.) January 12th, 1870.—'Dry Earth Closets *v.* Water-closets,' by Dr. Lombe. February 9th.—'Notices of Trap and Basaltic Rocks,' by Mr. Lee, F.G.S., Hon. Memb. of the Society. 'On the Rainfall on the St. Mary-Church-road, Torquay, during the six years ending December 31st, 1869,' by Mr. Pengelly. March 9.—'On the supposed influence of the Moon on the Rainfall' (*Ibid*). 'Notes on the Plants which had been injured in the Torquay district by the recent cold and high North-East Wind,' by Dr. Wilks. April 13.—'Notes and Observations on the effect of the recent severe Wind on the Evergreens in Torquay' (*Ibid*).—'Notes on the Correlation of the Middle Devonian Rocks of North and South Devon,' by Mr. Tawney, F.G.S. 'Note on the Odour emitted by Submerged Forests,' by Mr. Pengelly. May 11.—'On the Rainfall received by Gauges at the same Station, but at different Heights above the Ground' (*Ibid*). 'Note on the great Retreat of the Tide at Torquay on April 16th and 17th, 1870' (*Ibid*). 'The Modern and Ancient Beaches of Portland' (*Ibid*). In addition to the foregoing, the Monthly Reports of the Progress of the Exploration of Kent's Cavern, have been read to the meetings, by permission of the Committee appointed by the British Association to conduct the Investigation; and, from the commencement of 1870, Messrs. Fox, Pengelly, Stebbing, and Vivian have furnished monthly 'Notes on the Rainfall at Torquay.'

"*Conversazione.*—The society's annual conversazione was held in the Bath Saloon, on the evening of Thursday, February 24th, when a large and varied collection of objects was exhibited. The meeting was largely attended, and gave great satisfaction to the entire company.

"*Field Meeting.*—On Friday, May 20, the Society held a field-meeting in the neighbourhood of Dawlish, when the company examined the principal phenomena of the New Red Sandstone formation, so well displayed in the extensive Cliff section between the railway station and Langstone Point; the overlying Supracretaceous gravels; and the Warren, or quaternary accumulation of sand, at the mouth of the river Exe."

The financial statement was also presented.

The following committee were elected for the year 1870-1:—Dr. C. P. Blake, president; Dr. Wilks and Mr. Edmonstone, vice-presidents; Mr. Vivian, treasurer; Mr. Pengelly, hon. secretary; and Messrs. W. Hearder, Hounsell, Pollard, Stebbing, Tawney, Thomson, Timins, and Tothill, committeemen.

Thanks having been voted to the chairman, the meeting separated.

BELFAST MUSEUM.

THE annual meeting of shareholders took place on the 1st of June, at the Museum in College-square North.

The outgoing president of the Natural History and Philosophical Society, Dr. Wyville Thomson, occupied the chair.

The annual report by the council was read by one of the honorary secretaries, Dr. Henry Burden, and is as follows:—

Report of the Council of the Belfast Natural History and Philosophical Society for the Session 1869-70, *to the Shareholders of the Belfast Museum.*—A retrospect of the series of events which have marked the progress of your Society during the past year will, your council trust, prove as satisfactory and encouraging to you as it has already done to themselves. In the report of last year it was intimated that, in compliance with the widely-expressed desire of both bodies, the winter meetings of the Naturalists' Field Club and of your own Society would be held conjointly during the session 1869-70. The plan then proposed was accordingly carried out, and has been successful beyond expectation. The joint meetings have been largely attended, and papers of a varied and highly interesting character read at them. Subjoined will be found a list showing the dates of meetings, the subjects of papers, and the names of their authors:—1. Nov. 10th, 1869, Dr. W. Thomson, F.R.S., "On the aims of Natural History Societies, and the uses of Local Museums."—2. Nov. 17th, Professor J. Thomson, C.E., "The Jointed Prismatic Structure of the Giant's Causeway and other Basaltic Rocks."—3. Dec. 1st, Mr. J. J. Murphy, "The Origin of Organs of Flight."—4. Dec. 15th, Mr. W. J. Knowles, "Works of Art found in the Boulder Clay at Cullybackey." Dr. H. S. Purdon, "The Hair and Colour of Human Skin as Race Characteristics."—5. Dec. 29th, Mr. W. A. Ross, "Glass-making: its History, and the Causes of its Decline in this Country."—6. Jan. 12, 1870, Mr. W. H. Patterson, "A Description of an ancient Stone Coffer found at Movilla, County Down."—7. Jan. 26th, Mr. Robert W. Armstrong, "Ceramic Art, and the Pottery at Belleek, County Fermanagh."—8. Feb. 9th, Rev. Edward M'Clure, "Smell and Smells."—9. Feb. 23rd, Dr. Andrews, F.R.S., "On the Continuity of the Liquid and Gaseous states of Matter."—10. March 9th, Dr. J. S. Holden and Mr. Ralph Tate, F.G.S., "The Iron Ores associated with the Basalts of the North of Ireland."—11. March 23rd, Mr. Thomas Workman, "A Month on the Prairies." Mr. Wm. Gray, "On the Middle Lias near Ballycastle."—12. April 6th, Professor Thomson, C.E., "Illustrations of the Diffusion of Liquids." Dr. H. Burden, "The Aquarium."—13. April 27th, Dr. W. Thomson, F.R.S., "Animal Life at great Depths in the Sea." From the foregoing list it will be seen that there have been thirteen joint meetings, at seven of which papers were contributed by members of your own Society. Without wishing in the least degree to detract from the merit of other

contributions, your Council would direct your particular attention to two of those enumerated above—namely, one by Dr. Andrews "On the Continuity of Gaseous and Liquid states of Matter;" and the other, by your president, Dr. Wyville Thomson, "On Animal Life at great Depths in the Sea." These communications, it is to be observed, embody the very latest results of the scientific labours of their authors; results which are, at the present moment, attracting the profound attention of all those who are interested in the departments of science to which they refer.

It will not, it is hoped, be thought too much to say, with reference to the above circumstance, that it constitutes a noteworthy epoch in the history of your Society, and augurs well for its future prosperity.

On Easter Monday, the Museum, according to custom, was thrown open to the public at a nominal charge for admission; and a large, attendance of visitors, chiefly of the working classes, was, as usual, the result.

Several important changes have lately been effected in the internal arrangements of the Museum, due, in a great measure, to the active and friendly co-operation of the Naturalists' Field Club with your Society. The offer made by some members of the former body, and referred to in our last report, is in course of being carried out in a manner which is not only highly creditable to those concerned in its execution, but which will also materially increase the value and interest of your collections by rendering them more accessible for inspection and reference than they have been heretofore.

The naming and arrangement of the local shells is now completed. A few rare species in which the collection is as yet deficient will be supplied hereafter. The fossils are all named, but are not yet set out in the new cases recently ordered for them. A large collection of plants in your possession—a bequest of the late Mr. William Thompson—has been named.

"The coins are also fully described, and have been arranged in the special case set apart for their exhibition. The classification and arrangement of the remaining objects in the Museum is progressing satisfactorily.

In order to render the improvements in progress as effective as the means at their disposal permit, your Council have expended £100 in the purchase of additional mahogany cases for shells, fossils, &c. Ten of the new cases, and also a case for the collection of plants, have been placed in the lower front room.

The Museum building continues in good repair; the only outlay of moment required to preserve it in that condition having been for the re-glazing of the domes. Your trustees, taking into account the increased value both of the building itself and of its contents, have ordered an increase in the amount for which the property is insured. During the past winter the use of rooms in the Museum has been granted to the Ladies' Institute for their classes, and to Mr. W. H. Greer for some scientific lectures in connexion with his Athenæum.

The subject of extending the buildings of the Museum (by a special fund to be raised for the purpose), in order to afford still more space for the better exhibition of specimens, and at the same time to provide suitable accommodation for an aquarium, has been before your Council, but nothing has as yet been settled. They leave this matter entirely to the consideration of their successors.

Donation List for Session 1869-70 *to Museum.*—Rev. J. Macnaughtan, a red-throated diver; Thomas Garrett, Esq., several British birds; Mr. Wm. Hunter, a locust, caught in Belfast; Dr. M'Gee, a number of geological specimens from Wales and the United States; Dr. Holden, specimens of iron ore from Glenarm.

Donations to Library.—Rev. Dr. Glasgow, *New Testament and Gospel of Matthew in the Hindustani Language;* University of Christiania, a number of books and pamphlets; the Editor of *Scientific Opinion*, London, *Scientific Opinion*, from November, 1868, till April, 1870; Geological Society of London, their *Quarterly Journal*, vol. 25, parts 3 and 4; Royal Dublin Society, their *Journal*, No. 38; Zoological Society of London, their *Proceedings*, part 3 of 1868, and part 1 of 1869; Geological Society of Vienna, their *Proceedings* for 1869, parts 10 and 14; Smithsonian Institute, Washington, *Annual Report* for 1867; Academy of Natural Sciences, Philadelphia, their *Proceedings* for 1868; Boston Society of Natural History, their *Proceedings* for 1868, 1st part; their *Memoirs*, vol. 1, part 4; *Occasional Papers*, vol. 1, being the Entomological Correspondence of Dr. Harris; War Department, Washington, *Surgical Report in connection with the late American War;* Governor-General of India, *Memoirs of the Geological Survey of India*, vol. 5, parts 7 to 10, and vol. 6, part 3; *Records of the Geological Survey of India*, vol. 1, parts 1, 2, and 3, and vol. 2, part 1; *Annual Report of Geological Survey of India* for 1867; Royal University of Norway, several volumes of books.

Mr. Robert M'Adam submitted the treasurer's report; from which it appeared that, including £100 withdrawn for use from the shareholders' reserve fund of £500, there had been a total of cash received as income of £309. 18s. 8d. Of this there had been expended £241. 11s. 8d., comprising a special item of £100 paid for new cases for the lower room. This left a balance to credit of £68. 7s. to commence the new financial year with.

It was proposed by the Rev. Isaiah Steen, seconded by William Emerson, Esq., and resolved—"That the foregoing reports by the council and treasurer be adopted, printed, and circulated amongst the shareholders."

The deeds of tenure, trust-deeds, and other documents of the museum were then exhibited, compared by Wm. Emerson, Esq. and Joseph J. Murphy, Esq. with official record, and found all in order.

Dr. Wyville Thomson having brought before the meeting the fact that an invitation from the town of Belfast to the British Association for the advancement of Science was to be sent forward soon, requesting that learned body to meet in Belfast in the earliest year they could—1871, if possible—it was proposed by Dr. Henry Burden, and seconded by Robert M'Adam, Esq., and resolved—"That the Natural History and Philosophical Society join most cordially the other public bodies of Belfast in the proposed invitation to the British Association, and that the shareholders in the museum pledge themselves to further in every way the necessary arrangements for the reception of the association."

A council of management for the ensuing twelve months was then elected by ballot, consisting of the prescribed number—fifteen shareholders—who, out of the number thus elected, chose the office-bearers. The officers and council for 1870-71 were then declared to have been elected thus:—President—Robert Patterson, F.R.S. Vice-presidents—Wyville Thomson, LL.D., F.R.S.; James Thomson, LL.D.; Joseph John Murphy, F.G.S.; James Cuming, M.D. Treasurer—Robert M'Adam. Librarian — Rev. Isaiah Steen. Secretaries—Alexander O'Driscoll Taylor, Henry Burden, M.D. Other Members of Committee—Thomas Andrews, M.D., F.R.S.; R. Lloyd Patterson, Robert Mackey Wilson, John F. Hodges, M.D.; Robert Young, C.E.; John Anderson, F.G.S.

ARMAGH NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

The concluding lecture of this season was delivered by L. G. Mills, Esq., LL.B., in the Society's House, on last Wednesday evening, the Rev. Henry C. Irvine in the chair. After transacting the ordinary business, the chairman called on Mr. Mills, who proceeded with his lecture on "The Spider,' which he delivered with his accustomed ability. Several curious objects were exhibited through the Society's microscope, and a general conversation ensued on various matters bearing on the spider, its home and habits. On the motion of Thomas Smith, Esq., seconded by J. L. Riggs, Esq., M.D., the chairman presented to Mr. Mills the thanks of the meeting for his interesting address.

PHILADELPHIA (AMERICAN) PHILOSOPHICAL SOCIETY.

May 6th.—A paper "On the Geological Position, Character, and Equivalencies of the Marshall Group in the United States," Part II., by Professor Alexander Winchill, was read. An obituary of Horace Binney, jun., was read by Provost Stillé. Professor H. Allen presented a paper "On Some of the Effects of Age, as observed in the Osseous System," presenting changes in the pterygoid, molar bones, &c. Professor Cope read a paper "On the Fishes of the Tertiary Shales of Green River, Wyoming Territory," in which the horizon of the beds were shown to be probably near the Upper Eocene, or similar to that of Monte Bolca. A genus near *Pygaeus Agass.* was described. Professor F. V. Hayden presented three papers "On Tertiary Rocks of the Far West," with sections referring to a remarkable anticlinal of late age exhibited in one locality. Professor Cope exhibited the nearly perfect skull of a Dicynodont reptile, from South Africa, from the collection of Dr. E. R. Beadle, which he regarded as representing a new species and genus. He called it *Lystrosaurus frontosus*, and pointed out its relationships to the *Ptychognathus latifrons* of Owen.

May 20th.—The secretary communicated an account of a destructive hailstorm which recently visited the city, from Hector Orr. Professor Cresson described the same storm. He said there was a scud from the east, a heavy cloud above it from the south, and a highest layer of clouds from the south-west. All the stones had a nucleus of transparent ice, surrounded by concentric layers of snowy ice. Professor Cresson thought this very severe storm confirmed the truth of the hypothesis that the first water fall was carried upwards into the cold height of the atmosphere and frozen. The concentric layers were added during the passage through the clouds, during the descent; the disk-like form of others being due to more rapid rotation. The storm prevailed principally over the city; the hailstones were as large as walnuts, and broke most of the glass on the N.S.W. side of the houses. The corrugated iron roof of one of the manufactories in the city was pierced in over one hundred places.

Professor Cope exhibited a portion of the dorsal spine of a species of *Asteracanthus Agass.*, from New Jersey, the first representative of the genus found in America. He regarded it as indicative of the existence of a Jurassic or Oolitic stratum in that State—a point he had already suggested two or three years before.

Professor Cope made some observations on a new genus of Atherinid fishes found by him in a tributary of the Clinch River, in East Tennessee. It was stated to be near *Chirostoma*, but to present an elongate beak, somewhat like that of Belonesox. He directed attention to relations between the Atherinidæ and Cyprinodontidæ. He called the species *Labidisthes Sagittarius*.

Dr. Genth remarked that Del Rio observed gold and rhodium in Mexico, a compound unknown since that day. Dr. Genth found in a specimen of gold refuse from St. Domingo, obtained by Dr. Gabb, microscopic grains, mingled with minute topaz crystals, which were evidently a double chloride of one of the platina metals. With bisulphate of potash, sulphate of rhodium and potassium was exhibited, and the presence of rhodium gold proven. Dr. Genth stated that a certain amount of unmanageable gold dust had been sent from San Domingo, which he suspected to be rhodium gold.

BOSTON (U.S.) SOCIETY OF NATURAL HISTORY.

MAY 18TH.—Vice-president, Dr. C. T. Jackson, in the chair. Dr. T. M. Brewer exhibited a nest of the Baltimore Oriole (*Icterus Baltimore*, Linn.) made of the long southern moss (*Sillandsia usneoides*, L.). and said that Audubon had been criticised on account of a picture in which that bird was represented as standing upon a nest made of this material, it being said that the bird was never found where this moss grew. The nest which he exhibited was made entirely of this material; thus verifying the correctness of Audubon's drawing.

Mr. W. T. Brigham made a few remarks upon the photographs of two meteorites found some time since in California. One of the meteorites was a ring of intensely hard meteoric iron, whose greatest diameter was 49 inches, and whose least diameter 38 inches. Its weight was 1,600 lbs. The other was of very irregular shape, measuring 49 inches in one diameter, and 18 inches in the other.

Mr. Brigham also described a lava deposit in the vicinity of Mount Hood, in Oregon. The Columbia River has worn a passage through the mass, exposing a wall of lava in some places between two and three hundred feet high. This wall is more or less decomposed, and worn into buttresses and pinnacles. The lower portion of this lava mass is of a different texture from the upper portion, though composed of the same materials. It is more easily decomposed than the upper portion, and is worn to a greater extent. The fresh surface of the fragments showed that the wearing had not been done by the river. Below the lava is a bed of volcanic conglomerate. Till a thorough survey of this territory was made, it would be impossible to tell whether this lava originally came from Mount Hood, or from some other volcano now extinct.

Mr. Brigham described the form and dimensions of two giant Legnoia trees found in the Mariposa Valley (Cal.). The bark of the larger of these trees had been burned by fire, but its original circumference must have been over 93 feet. The tree branched at 150 feet from the ground, and the branches at this point were 6 feet in diameter. Another tree of the same kind, near by, was between three and four hundred feet high, and from twenty-five to thirty feet in diameter.

Dr. F. H. Brown, a paper containing a complete list of the Ferns in the island of Madeira.

Dr. C. T. Jackson, in some remarks relative to Mr. Brigham's description of the California Meteorites, stated that no meteorites had been found in the Tertiary or any of the more ancient deposits; from which he argued that the phenomenon of meteoric showers was a phenomenon of the present period. He described their composition, and alluded to some of the more remarkable ones which have been found in different parts of the world. The intense cold observed in meteorites which have just fallen, was, he thought, a proof of Fourier's theory of the coldness of interstellar space.

Mr. W. H. Niles offered some remarks upon the system observed in the Physical Features of Massachusetts. In order to arrive at a clear conception of the principles involved, Massachusetts must first be considered as a portion of the North American Continent. An analysis of the physical features of the continent shows how certain laws governing its formation are also at the foundation of the laws upon which depend the features of the State. Massachusetts is thus shown to be situated upon the eastern slope of the northern section of the Appalachian mountain system. Her situation upon this eastern slope gives the law of the increase in height from the eastern to the western borders of the State. Her position in the northern section of the range, and south of the culminating parallel which passes through the Adirondack, Green, and White mountains, gives the law of a general surface increase in height northward. Sections running entirely across the State in an east and westerly or north-southerly direction, show that these laws, upon which depend the surface features of the State, are of primary value. An examination of the State itself shows that it is traversed in a northerly or southerly direction by two distinct regions of high land and two of low land. Though the eastern portion of Massachusetts has usually been considered as being very irregular and broken, Mr. Niles said he had been able to trace several distinct ranges, which he briefly described. Most of them show a general parallelism with the other Appalachian ranges. The "Blue Hill" range of Milton and Quincy, trends east and west, and the other rows of low hills in the vicinity of Boston are approximately parallel. The general strike of the rocks appear to be nearly parallel with the trend of the hills. Mr. Niles believed these east and west ranges to be axes of elevation of a secondary force, acting in a somewhat different direction from the primary one, which determined the prevailing course of the Appalachian Mountain System.

Mr. Niles hoped to bring this subject before the Society at some future time in a more complete manner, illustrating it by a map which is now in course of preparation.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

PARIS, JUNE 6TH.—M. Elie de Beaumont brought forward the correspondence. Amongst other papers was one by M. Duchemin, on "A New Electric Pile."

This new electric pile differs from that presented by M. Duchemin to the Academy in 1865, and also to M. le Ministre de la Marine. This apparatus, on being placed in contact with the sea, becomes instantly a source of electricity, by reason of the oxidizing action of the liquid which surrounds it, as well as by its agitation and perpetual renewal; but the quantity of electricity obtained being proportionate, and, *cæteris paribus*, the amount of oxidation produced, M. Duchemin asks if there is no means of ascertaining whether the action of certain chemical bodies held in suspension around zinc or coal, would not be the same as that which takes place in ordinary batteries, to increase the physical effects of his apparatus, without changing the part or metallic surface destined to advance the work of oxidation. In order to make this experiment, M. Duchemin had recourse to a pile, of which the following are the details:—A perforated vase placed on a cross piece of wood, and supported on a float. This vase is protected by a cylinder made of thick zinc and pierced with holes, the *stem* of which represents the negative pole. In this vase is placed a piece of carbon, on top of which the positive conductor pole is placed. This piece of carbon is surrounded by *débris* of coke and of perchloride of iron. The top of the vase must be properly closed. This model of an element utilized in the sea has the advantage of enabling it to be placed in separate compartments, and produces the explosion of submarine mines. M. Duchemin observed that, at first, one would be led to think that the action of the perchloride of iron contained in the vase should diminish immediately, by reason of the motion of the liquid; but this does not occur, by reason of the density of the water. Under the influence of the salt water the zinc decomposes the liquid. The hydrogen passes to the perchloride; and in this case the electricity shows itself in a manner worthy of attracting the attention of scientific men.

M. Ch. Robin presented a new work by Professor Feltz, of Strasbourg, on "The Genesis of the Pus Corpuscles. M. Feltz endeavoured to prove last year that these white corpuscles are not occasioned by the passage of the white globules of blood through the vessels. The latter researches confirm the former, and tend to show the generation of the pus corpuscles in the tissues, which are not vascular, such as the cornea and cartilage.

M. Henri Sainte-Claire Deville read his second memoir, on "The Action of Water on Iron, and of Hydrogen on Oxide of Iron."

M. Des Cloiszeaux read a paper on "The Optical Properties of Benzile, and some Bodies of the Camphor Family in a Crystallized State and in a State of Solution."

M. Frémy made a short communication on "The Products of the Reduction of Nitrous Acid by Metals." This product is oxyammonia, a remarkable body, which has been discovered but a very short time since.

The meeting was then brought to a close.

NOTES AND MEMORANDA.

Diving Apparatus.—The efficiency of Mr. Siebe's diving apparatus has long been acknowledged, and at the "Engineer's" conversazione, held recently, an opportunity was afforded for examining the several parts of the apparatus. In some recent experiments at Chatham Dockyard, air was supplied to both the divers by means of the one pump, and after walking a considerable distance, and remaining under water some time, the divers returned to the surface, both stating that they were furnished with abundance of air, while neither suffered

the slightest inconvenience. Not the least of the advantages of Mr. Siebe's invention is the fitting of the diving apparatus with a self-acting pressure-gauge, which registers the pressure in pounds, while a submarine lamp can also be applied to the pump, by which means the diver can be assisted by a steady light when employed in exploring the interior of a vessel, or descending to any depth to which the light of day does not penetrate. The Admiralty diver subsequently descended to the great depth of 108 feet with the two cylinders of the air-pump connected, followed to the same depth by Sergeant Baker, of the Royal Engineers, who made his first descent; when, even at the depth and under the conditions stated, not the least inconvenience was experienced by either of the divers, who remained down for some time, the valves, gauge, register, and other parts of the apparatus, all working most satisfactorily. The officers and men at the Royal Engineer establishment will commence their summer course of practice in diving operations with Mr. Siebe's apparatus and the improved air-pump.

Cabbage Tree of New Zealand.—It may not be generally known that the cabbage tree (*Cordyline Australis*) which grows so abundantly in New Zealand, contains a very considerable proportion of saccharine matter. In former years, says *Applied Science*, the Maoris used, when on their fishing excursions up country, to hack down a few of these trees near their encampments, and after a day's exposure to sun and air, cut off quids, which they chewed with great gusto. Fifteen years ago a gentleman resident in Otago obtained a fair sample of sugar manufactured by the Maoris from the cabbage tree, which he sent to London for inspection. The process for extracting the sugar, so far as we are aware, has not been divulged by the natives, and probably no individual European is conversant with the matter. It might, then, form an interesting subject for inquiry and dissertation how the process was accomplished, and how far could the tree be utilised for such a purpose. The cabbage-tree may be readily propagated from seed, and its growth is comparatively rapid. The whole tree is fibrous, and can be made into paper. It grows to a diameter of from 1 ft. to 3 ft., and height from 10 ft. to 20 ft., and is found chiefly in swampy situations, although it grows on hill sides. The stem is thickly fibrous, and the leaves, which are long (ribbon-like) and about 2¼ in. broad, contain a good deal of fibre.

Discovery of Coal in Colorado. — The following letter, dated New York, May 10th, was published in the *Mining Journal* of June 4:—There has been a great discovery of coal near Denver, Colorado, and if it should prove on examination only about one-half what is represented, it will be an important discovery indeed, for the Pacific Railway can then be supplied with coal in a central point of its course instead of taking it from its extreme ends. Two specimens sent me I have recently been analysing, and find they will do very well for the generation of steam, but are too light for iron furnaces. It is a lignite of first-class quality, very brilliant, burns with a very strong flame, has the odour of bitumen, gives out great heat, very little sulphur, does not coke well—that is to say, the coagulation is slight. The samples I had were small, so I could not duplicate the tests; the two I tried gave as follows:—

Water	9·50
Volatile and Bituminous	39·65
Carbon	42·70
Ash	8·15 = 100·00

The carbon was very spongy, and absorbed nearly 8 per cent. of moisture from the atmosphere within 48 hours after exposure. I leave for Colorado this week, and shall send you some notes. While there I shall have a look at the "Terrible," as I have to make an examination of some other mines in that neighbourhood. A fine cinnabar vein has been found in the mountains of that district, but the Indians are troublesome near where it is situate; the specimens shown me are equal to the New Almaden ores.

A Large Block of Coal.—A block of new mine and fire-clay coal, weighing no less than 3 tons 15 cwt., has just been raised from a pit in the New Priestfold Colliery, at Willenhall, of Messrs. Ward & Son. It is 18 ft. in circumference, is 4 ft. 6 in. thick, and is 6 ft. long. It was cut by one man, who, no doubt, had to exercise much care in bringing it down in a piece. Its great weight straightened one of the hooks of the draw-chains, and it was not without difficulty that the engine drew it to the surface. Messrs. Ward had it cut for a hospital bazaar now being held at West Bromwich, to which it has been sent alike as an exhibit and as a donation. Some time ago a piece of coal weighing 5 tons 17 cwt. was got out of the same colliery.

Baron Liebig is reported to have been for some time suffering from nervous headache, and, after some improvement, is now laid up with carbuncle. His physicians consider that he is likely to do well, as his health, for many years, has been excellent. The Baron is now sixty-seven years old.

Inspectorship of Vaccination. — One of the appointments as Government Inspector of Vaccination is now vacant. The appointment is in the gift of the Privy Council.

Mr. Syme.—The *Lancet* states that the fears it expressed last week as to Mr. Syme's surmounting his last seizure were too well founded. He is not expected to recover—the power of speech being not yet regained, and the loss of deglutition so complete that he has to be sustained by enemata.

SCIENTIFIC DIARY.

WEDNESDAY, June 15th.

Meteorological Society, 7 p.m. Annual Meeting, Election of Officers, &c.
East Indian Association, 3.30. "On the Shortcomings of the Present Administration of Hindu Law," by Dr. Goldstücker.

THURSDAY, 16th.

Royal Society, 8.30 p.m.
Society of Antiquaries, 8.30 p.m.
Linnæan Society, 8 p.m. "Two species of Serapias which occasionally present Semi-labelliform Lateral Sepals," by Mr. J. T. Moggridge.
Chemical Society, 8 p.m.
Numismatic Society, 7 p.m. Annual Meeting.
Zoological Society, 4 p.m.

FRIDAY, 17th.

Philological Society, 8.15 p.m. "Old English and Anglo-Saxon Pronunciation," by Dr. Weymouth.

SUNDAY, 19th.

Sunday Lecture Society, 8 p.m. "On Volcanoes," by David Forbes, Esq., F.R.S.

MONDAY, 20th.

Asiatic Society, 3 p.m.
London Institution, 4 p.m.

TUESDAY, 21st.

Statistical Society, 8 p.m.
Ethnological Society, 8.30 p.m., at the Royal United Service Institution, Whitehall-yard (by permission of the Council). "On the Aymara Indians of Bolivia and Peru," by David Forbes, Esq., F.R.S.
Birmingham Natural History and Microscopical Society, 7 30 p.m. Conversazione and Exhibition of Specimens. Short papers from the Conchological Section, &c.

WEDNESDAY, 22nd.

Geological Society, 8 p.m.

MAGNETIC FLAMES FROM THE SUN.—"P. H. G."—The statement you have sent us was seen by us some three weeks since. It is, of course, the purest nonsense. It, we believe, originated in a paragraph in an American newspaper.

COSMICAL CLIMATES. — "R."—We have returned the MS. as you requested. We think, under all circumstances, the course adopted is the correct one.

GEOLOGIST'S ASSOCIATION.—"J. M."—The notice reached us too late to admit of our sending you a proof. You may be sure that otherwise we should have complied with your request.

SUNDAY LECTURE SOCIETY.—"D."—The MS. is to hand, and shall appear. You seem to have forgotten the request for a second ticket.

MILITARY EDUCATION.—"T. R. J."—Thanks. The letter shall appear. The subject is of great importance, and has already received a notice in these columns.

NOVA-SCOTIA INSTITUTE.—The president's communication has reached us. Thanks.

AN IMPROVED EASY CHAIR.—"L."—The request shall be attended to. In a medical point of view the matter is interesting.

GEOLOGICAL EXCURSIONS.—Our correspondent's notice reached us just in time for insertion.

PHOTOGRAPHIC OPTICS. — "P. G."—The index of refraction will be found for the substance named, in any ordinary book on Optics.

SEWAGE.—"L. T. W."—We cannot undertake to publish the letter. Clearly it is libellous.

BATTERY POWER.—Consult Professor Fleeming Jenkin.

WEDNESDAY, JUNE 22, 1870.

A MINISTER OF PUBLIC INSTRUCTION.

THE discussion which took place in the Commons on Monday night, on the subject of Mr. Forster's new Education Bill, was one highly suggestive to those who are watching with interest and anxiety the present phase of the public instruction question. Notably so were some of the remarks which fell from Dr. Lyon Playfair; though, in so far as the member for the University of Edinburgh touched on the Irish question, his views were merely a combination of ignorance of the condition of the Irish people and Scotch prejudice toward Ireland.

Irishmen and Scotchmen proverbially hate each other, pretty much in the same way as the Irish and Chinese hate each other at San Francisco; and so we may pass over Dr. Playfair's rabid observation to the effect that the only result of education in Ireland had been to teach the people to read seditious papers. Dr. Playfair finds Ireland unhappy and unprosperous, and so he at once assumes that if education did not remove these evils it ought to have done so. But this conception is really too absurd to notice at any further length.

The Scotch member, however, hit a very important truth, and pointed to a very urgently-demanded reform, when he said:—"If the House were called upon to recognize national education, they ought to overhaul the whole of the educational machinery. The Government ought to have come boldly to the House and to have asked for a Minister of Education, who would be responsible, not only for the action of his department, but for all the educational grants, both for secondary and higher education, in corollary with each other. At present the Minister of Education was called upon to consider how he should prevent the spread of the diseases of cows and sheep, to take measures for carrying out vaccination, and to consult with medical officers about fever and cholera—all very important duties, but which were quite incompatible with the consideration that ought to be given to the great question of education." Therein lies really the secret of the imperfection of our existing system. We have no one in authority who is solely responsible for, and whose whole attention is concentrated on the manifold questions of national education. What we want is some experienced and intelligent Minister, whose only duty it would be to consider educational problems, and who might, at length, by gradual reformation, unify the numerous discordant schemes which now exist, remove altogether the sectarian element, and, finally, make the education of children as compulsory as vaccination, or any other of those broad measures which constitute the illogical, but not the less useful, features of our present constitution.

Till some such authority is established, we shall have to wait ere we possess a scheme of education satisfactory to the public mind; and, if Mr. Forster's somewhat lop-sided and unsymmetrical measure ever results in such a consideration of the subject as may lead to this desired consummation, we shall have reason to be grateful. Nothing short of this can satisfy the demands either of intellectual advancement, or the will of the people; and to this we must come at last. It is true that the leaders of the present Government imagine that the Bill now before the House is one which meets all difficulties; but this is a mistake, arising, doubtless, from the fact that Mr. Gladstone and others, pressed heavily by the numerous claims on their time and mind, have not had sufficient means of gauging the National opinion. That the measure is a step in the right direction no one can for a moment deny; but its prospective benefits are marred somewhat by the presence of the denominational plague-spot, and till that is removed, and the whole legislation of the subject placed on a broader and more liberal basis, the wishes of the English people will not have been complied with. And if this end is to be achieved, it can, in our opinion, only be accomplished through the help of a "Minister of Public Instruction," whose mind shall not be trammelled by the cares of departments which have no earthly connection with educational problems. We, therefore, thank Dr. Lyon Playfair for the outspoken candour with which he has pointed to the evil of the existing state of things. He has really, in suggestion, cut the Gordian knot; or, to use a more homely expression, has taken the "bull by the horns."

And, while we are on the subject of the recent debate, we would say a word about the tendency, even among educated men like Dr. Playfair, to display their patriotism to a degree which renders it almost ridiculous. Indeed, the laudation of his countrymen and their institutions which the member for the Edinburgh University indulged in on Monday night, reminds us of the following amusing anecdote, with the recital of which we will close our remarks:—A gentleman, speaking to a Scotch friend of the extreme Rowdyism of New York, spoke of the ruffians of the great American city as the worst in the world. "Ah," said his friend, in reproachful expostulation, and not to be outdone in patriotism, "ye should see the bla'gards on the Clyde." We commend the story to Dr. Playfair's notice—it points a useful moral.

THE WEEK.

Since opening this department, we have received so much assistance from friendly correspondents in different parts of the world, that we are led to believe that our readers may, with very little trouble to themselves, aid us in making "The Week" a most comprehensive record of current events in the scientific world. We therefore appeal to all our friends to lend us, not merely their "ears," but their hands, and to send us any weekly "jottings" of interest relative to matters occurring in their neighbourhood. "The smallest contribution" will be accepted, and, seriously, the briefer and more terse the notes are the better. Secretaries of societies, metropolitan and provincial, librarians, curators, lecturers, and teachers, may all do something in their turn.

ON Sunday evening last, Mr. David Forbes, F.R.S., delivered a lecture in the Rooms of the Sunday Lecture Society at St. George's Hall. The subject chosen was that of Volcanoes, and the lecturer's remarks were attentively listened to by a large and distinguished audience, among whom we recognized some of our most eminent British geologists. Mr. Forbes gave a general sketch of the whole of volcanic phenomena, and drew from his personal experience of South American earthquakes and volcanic action a very graphic picture of some of these terrible cataclysms. He adverted to the division of geologists between the Plutonic and Neptunic schools, and pointed out the necessity of recognizing both sets of forces—aqueous and igneous—in the operations which have given the globe its present shape. The lecturer finally dwelt on the great importance of collecting facts, and on the caution with which they should be applied to particular hypotheses; and he concluded amid much applause.

WE learn, from the interesting "Science Gossip" of the *Athenæum*, that the *American Journal of Science and Arts*, long familiarly known as *Silliman's Journal*, will complete its second series of fifty volumes next November. The first series, which ended in 1845, was quarterly; the second has been two-monthly, and the new series, as the editors now announce, is to be published monthly. This will be acceptable news in many quarters, for *Silliman's Journal* stands at the head of the periodicals which record the progress of science in the United States. We trust that this new project of more frequent publication will be rewarded by a large increase of circulation.

THE *British Medical Journal* is usually so well informed in matters relating to science that we cannot but think that in inserting the libel on the *Chemical News* contained in the following paragraph, it has been the dupe of some unconscientious person, who desired to vent a private feeling of malice:—"The Council of the Pharmaceutical Society, having decided upon making

[illegible] a weekly publication for the future, has advertised for an editor and sub-editor. The contemplated change is one that has long been needed; for, though the *Chemical News* seems to maintain its existence by cultivating a circulation among druggists rather than by adequately representing general chemistry, it does so only in such a way that it is neither a pharmaceutical, chemical, or pharmaceutical journal." Of all physical journals the *Chemical News* least seems to cultivate the druggists. It has always been an excellent representative of physical and chemical science; and of late, by the introduction of an admirable survey of foreign science, it has surpassed in excellence and usefulness all other periodicals devoted to physics and chemistry. Mr. Crookes, its accomplished editor, has seen at so much pains to meet the wants of his readers, that we should be countenancing a flagrant piece of injustice if we allowed the statement in the *Medical Journal* to pass unchallenged. We feel sure, too, that the editor of the journal, as soon as he discovers the error into which, doubtless, he has been inadvertently led, will, with his usual courtesy, recall the unfair comments we have quoted.

On Saturday evening, the 11th instant, the members of the Geologists' Association made an excursion to Hampstead Heath, under the guidance of Professor Morris and Messrs. S. E. Pattison and C. Evans. The party met at six o'clock at the Swiss Cottage Station, and proceeded to Hampstead across the Conduit Fields. The position of the Midland Railway tunnel, excavated in stiff London clay, containing *Nautilus, Pholadomya, Corbula*, and other fossils, was pointed out; and, halting on the rise of the hill, Professor Morris explained the geological structure of the extensive district seen to the south and south-west, including the chalk range of the North Downs and the Tertiary hills of Norwood and Richmond. The sections of the Middle Eocene, or Bagshot sands, by the sides of a new road near the Sailors' Orphan School, were then examined, and the position of these sands, forming a capping of the hill, and resting on the London clay, was explained by Mr. Pattison. The age of a pebbly bed, resting on an irregular surface of the sands, gave rise to some discussion. It was observed that many of these pebbles had their longer axes in a nearly vertical position. After a brief visit made to the tomb of Mr. Daniel Sharpe, a late distinguished president of the Geological Society, the party walked through Frognel and across the Heath to the "Leg of Mutton Pond," at North End. Here patches of the London clay, which had been raised to the surface during some drainage works, were seen, and specimens of *Pectunculus decussatus*—a fossil characteristic of the "Highgate zone" of the London clay—were obtained. From an adjacent hill, capped by the Bagshot sands, Professor Morris pointed out Harrow Hill, also capped with sand, and explained that this upper deposit must once have been continuous, and that the intervening valley had been formed by denudation; he also explained that the sand at the top of the hill was a water-bearing stratum, giving rise to several streams at the junction with the subjacent clay, and that the numerous minor valleys descending from the hill had been formed by these streams; good examples of these valleys were seen at North End and at the Vale of Health, the pond at the latter spot forming the headwaters of one of the branches of the Fleet. The sands were also examined in the large pit on the top of the Heath. After a visit to the chalybeate spring in Well Walk, the members concluded a very pleasant excursion by proceeding to the residence of Mr. C. Evans, at Downshire Hill, and inspected his collection of London Clay fossils, many of which had been obtained by him from the railway and drainage works in the immediate neighbourhood of Hampstead.

The following excursion is proposed by the Geologists' Association:—Thursday, 23rd June.—To Watford, by the train which leaves Euston Station at 2.10 p.m. The party to alight at Bushey Station. The last ordinary meeting of the Society will be held on Friday, July 1st, at eight o'clock in the evening.

The *British Medical Journal* gives an excellent account of the laboratory of St. Bartholomew's Hospital, which has recently undergone great improvements. During the past year, this laboratory has been materially improved—first, by laying on steam and distilled water; and secondly, by arranging a suitable apparatus for the testing and evaporation of urine. The old lecture-room has been pulled down during the past year, and rebuilt. The arrangements of this room are of a very perfect order. First, the seats are not arranged in the usual uncomfortable style which is prevalent in medical schools, but are of a more comfortable description, having good backrests, and being conveniently arranged for taking notes, and will accommodate one hundred and ten students. The lecture-table is considerably raised above the floor, thereby placing the lecturer on the same level as the middle of his audience. The whole wall at the back of the lecture-table is taken up by cupboards for lecture apparatus; but at the same time these have double doors, the outer one being made of slate, thereby serving as black-boards. At the side of the lecture-table there are cupboards, steam cupboards, lift, &c.; in fact, the whole appears to be most admirably adapted for the purpose for which it is meant. The old private laboratory has also been perfectly re-arranged, and has been fitted up with every convenience; viz., slate distilling table, distilled water, steam, speaking-tubes, &c. The authorities have also excavated a large room under the lecture-room, which can be used as a furnace-room, and is especially adapted for large chemical operations. Here again we find steam and distilled water laid on, as well as a very fine slate-table for distillations; and in the centre of the room a large working table. At one end of the room a large glass case is fitted up for combustions, and on the other side a large cupboard for operations which give off noxious fumes. We find here also huge gas-holders for oxygen and hydrogen. The gas may be either used in this room or on the lecture-table, pipes being connected with it. Besides the above rooms, there are three or four small rooms; viz., weighing-room, electrical-room, and apparatus-room, all conveniently fitted up.

At the last exhibition of the American Institute, there was seen an elliptic lock-stitch sewing-machine, driven by a small electric engine which might easily be put into a common hat-box. A series of eight magnets are set on the periphery of a circle, and around these revolves an armature of steel, which is continuously propelled by the magnetic action, and thus operates the machinery that moves the needle. The current may be cut off entirely, or the speed of the needle graduated as may be desired. The inventor is one Charles Gaume.

The Senate of the Queen's University of Ireland have adopted resolutions claiming that its Doctorate of Medicine shall admit to the State examination under the new Medical Bill, and that diplomas granted under that Act shall not specify in what division of the United Kingdom candidates may have been examined.

An important discovery is said, by the *North German Correspondent*, to have been made at Jerusalem. It is an old stone, bearing the figure of a god sitting on a throne, with priests on both sides, and a Hunyaritish inscription two lines in length. It was brought from Yeman, and was offered for sale. Dr. Oscar Meyer, the Chancellor of the North German Confederate Consulate, obtained an impression, which is at present in the hands of the Confederate Consul, Dr. Blau, who is residing for a time at Berlin. The inscription is said to contain the name of "Athtar," or Astarte.

The collection of the productions of art and science, now being exhibited in the Mechanics' Hall, Darlington, is valuable and extensive. The objects which claim and receive chief attention are the paintings, which, though not properly a legitimate element in the collection, are additions and attractions which the committee secured. Among the results of the labours of skilled mechanics, are an oak and elm Gothic side-

board, and other articles of furniture worth exhibition; specimens of graining and panelling; an electro-magnetic apparatus for working the block system on a railway; a model of a revolving fort; McDermid's patent paper-hanging machine, &c. The opening ceremony took place under the presidency of the Mayor of Darlington.

Dr. Hooker and Professor Flower have been appointed examiners for the Natural Sciences Tripos of Cambridge. Mr. Savory and Mr. Lestourgeon have been nominated examiners for the degree of Master in Surgery; and Dr. Drosier and Mr. J. Wood for the degree of M.B.

The Lectureship of Practical Physiology and Histology is rendered vacant by the appointment of Dr. Michael Foster to the Professorship of Physiology at Cambridge.

It is with much regret that the *Lancet* is unable to report any improvement in Mr. Syme's condition. He is still conscious, but has not regained the power either to speak or swallow.

The Registrar-General, referring to the continued drought, states that since March 17 the total rainfall at Greenwich has only been 1¼ in. in 16 out of 86 days; no rain has fallen on 70 out of the 86 days. It is a satisfaction, though oftentimes a melancholy one, to have a standard of comparison by which we can estimate our present position. As regards drought, that standard is supplied by the year 1864, the driest of which we have any certain evidence on record. In 1864 there was a deficiency of rainfall on the entire year of 7¼ in.; but the fall during the first five months of 1864 was 7 in., whereas only 4·9 in. have been measured this year at Greenwich. Thus far, then, the present year compares unfavourably with the exceptionally dry year 1864. The "April showers" have this year been conspicuous by their absence, and those of May equally so. Less than an inch of rain has fallen in those last two months, their average fall being at least 4 in. May especially has been dry beyond precedent, its fall of half an inch being an inch and a half less than the fall in the corresponding month of 1864.

The *Gardener's Chronicle* states that the receipts on the occasion of the recent show of the Manchester Botanical and Horticultural Society amounted to the very satisfactory sum of £1,650, of which amount £1,100 was taken in shillings.

The 27th anniversary dinner in aid of the funds of the Gardeners' Royal Benevolent Institution will take place at the London Tavern, Bishopsgate-street, on the 29th of this present month. The Right Hon. the Earl of Derby has kindly consented to take the chair.

Professor Fleeming Jenkin has discovered and patented a new method of lighting the beacons and buoys on the seacoast by electricity, giving a bright, permanent, and unmistakable light to guide the mariner and preserve him from treacherous rocks and shoals. The light is produced by a rapid succession of sparks, due to successive charges and discharges of a condenser situated upon the beacon or buoy. This is charged directly with a voltaic battery, without the intervention of an induction coil. The communication is made by means of submarine wires, running from the shore to the beacon or buoy, and can be operated thoroughly by parties on shore. The invention is considered in all respects practicable; and it is certainly to be hoped that it is so, and we hope to see it adopted on the dangerous parts of our coast, as one of the means of rendering less the dangers of the seas.

In the province of Guzerat, Bombay, an exhibition, devoted mainly to cotton in all its states, from the raw product to the most highly-finished manufactures of the loom and the needle, has just closed. It was situated at the town of Broach, celebrated for the excellence of its cotton wares, and its creation and successful conduct were due largely to the exertions of an Englishman, Mr. Greaves. Pecuniarily, no profit arose from the exhibition; but the receipts balanced the expenditure, and nothing is owing to anybody concerned except a heavy debt of gratitude to the gentleman named. Fifty-one medals have been forwarded to Broach for presentation to the exhibitors.

On Friday, the 24th instant, a conference will be held by the India Committee of the Society of Arts on the subject of overland routes between India, Eastern Thibet, Assam, and China. The conference will be opened by Mr. T. T. Cooper.

The last number of the *Scientific American* gives the following interesting notes on Chinese Therapeutics. The Chinese divide medicinal substances into healing, cooling, refreshing, and temperate. Their Materia Medica is contained in the work called the *Pen-taoscang-mou*, in fifty-two large volumes, with an atlas of plates. Most of our medicines are known to them and prescribed; also, mineral waters, with which the country abounds. They also have animal magnetizers, called *Cong-fou*. They divide their prescriptions into seven categories, viz.:—1st, the Great Prescription; 2nd, the Little Prescription; 3rd, the Slow Prescription; 4th, Prompt, or Through-by-daylight Prescription; 5th, the Odd Prescription, for fools, madmen, hypochondriacs, and the hysterical; 6th, the Even Prescription, for the wise and good; 7th, the Double Prescription, for those in the family way. Each of these recipes is applied to particular cases, and the ingredients that compose them are weighed out with the most scrupulous accuracy. The physician never pays a second visit unless sent for, and sometimes his services are no longer needed.

The latest returns show that a single establishment in New York—the Singer Sewing Machine Company—turns out 500 sewing machines per diem. The works are going night and day.

The *Athenæum* understands that the question as to who shall be President of the British Association on the expiration of Professor Huxley's year of office in 1871, proves to be much more difficult of solution than was anticipated. Sir William Thompson was talked of, but he has declined to allow himself to be put in nomination, and so has Dr. Tyndall, to whom an offer was made of the peripatetic dignity. These two gentlemen have enough, and more than enough, of legitimate work to do, to justify their refusal. The University of Glasgow has claims on the one, and the Royal Institution on the other, which ought not to be set aside, and are far beyond those of the British Association. Great Britain could now do without the British Association—a body which may be said to have done its work—but is not yet prepared to give up expecting great things and a high quality of work from the successor of Davy and of Faraday.

Her Majesty's Commissioners have resolved to set aside one guinea out of every season ticket sold at three guineas through the Society of Arts, for the purchase of Works of Art and Industry out of the Exhibition, the same to be circulated throughout the United Kingdom.

In the course of a few days an attempt to raise the steam-tug *Brother Jonathan*, lying under water near the Prince's landing-stage, Liverpool, will be made; the proposed *modus operandi* being that of placing empty balloons inside the vessel, and inflating them from above. It is expected that as the water is thus forced out of her, the tug will gradually rise to the surface.

Escape of a Snake from the Zoological Gardens. — On Monday last a snake was seen near the broad walk of the Regent's Park. Those who saw it were afraid to touch it; but when the keeper arrived he looked at the reptile's head, and saw at once that it was an English snake. He immediately seized it by the tail, and took it back to the house whence it had escaped, amidst the manifest amazement of the spectators.

ORIGINAL COMMUNICATIONS.

[Under this head we propose to publish Papers communicated specially to the pages of this Journal.]

MICROSCOPIC ORGANISMS IN MILK.

BY C. STANILAND WAKE, F.A.S.L.

IN TWO PARTS.—PART II.

THE general results I have detailed agree, it is evident, pretty closely with those obtained by M. V. Essling. They certainly do not, however, agree with the conclusions arrived at by Mr. Dancer. This may, perhaps, be accounted for if the conditions of Mr. Dancer's experiments are considered. 1. A bottle was filled with milk and securely corked, but whether exposed to the light or not does not appear. After eleven days had elapsed *no* change was discoverable by the aid of the microscope. 2. Milk in an open cup was placed in a cabinet closed during the day, and after the lapse of eleven days, although it had "become thickened into a pasty mass, with an intensely sour odour," yet it "exhibited no appearance of the *Mucor mucedo*, or any other vegetable or animal organism." The only difference observable was in the oil globules, which had begun to lose their spherical form. 3. Milk in an open cup was placed in a closet (the atmosphere of which was known "to be favourable to the growth of fungi, the *Mucor mucedo* being the most abundant and of the same family as that mentioned as having been found in cream by M. V. Essling." On the sixth day this milk had patches of mould on its surface, this mould being the *Mucor mucedo*, but no trace of it could be found "in the milk taken from various depths." It should be added that, when another sample of milk was placed under the same conditions as No. 3, "no *Mucor mucedo* appeared in or on it, although exposed in the closet for the same length of time as Mr. Kipping's milk, which showed signs of this growth on the sixth day, and on the 12th day the town milk had none visible." The result of the second experiment would seem to be inconsistent with the assumption that the fungus which appeared in the preceding one was due to the spores of *Mucor mucedo* existing in the cupboard. Can any other explanation of the varying results of these two experiments be given? In the absence of perfect knowledge of the conditions under which they were made, I can only suggest that the difference of result may have arisen from one or more of the following causes: a greater exposure to the action of *light* in one case than in the other, a higher temperature, or a difference in the quantity of milk employed. There is no doubt that *quantity* of an organic infusion may sometimes affect the result, and in the mere filling of the bottle in experiment 1, I see a sufficient reason for the failure it exhibited. As a rule, the influence of air, probably in the mode explained by Dr. Carpenter in relation to deep-sea life,[1] is just as essential to the development or support of microscopical organisms as it is to the life of man or plant, and its exclusion was one of the conditions of No. 1. Another condition which without doubt vitiated experiment No. 2, and which probably also operated in the case of No. 1, was the exclusion of *light*. The influence of light on *vegetable* life especially is well known; and hence, its exclusion or otherwise may be sufficient to account for the varying result of the two experiments. No. 3. Difference of temperature may also, as I have already suggested, have affected the result in these two instances. Another circumstance, which affects all Mr. Dancer's experiments alike, is the short period over which they extended. It seems to me that, under the conditions named, *eleven* days was much too short a period to allow of fungi being developed, supposing those conditions to be such as to allow of their being developed at all. In fact, certain changes, not to mention the fungus of No. 3, did take place in experiment No. 2—the "pasty mass," and the loss by the globules of their spherical form,—which are very suggestive of what might possibly have ultimately resulted, even in the absence of daylight, if the experiment had been continued long enough. In fact, Mr. Dancer himself states that some of the globules coalesced—under the microscope, I suppose,—and formed an elongated mass; and why the same thing should not occur in the cup itself does not appear. The formation of mould on the surface only of the fluid agrees well with my own experiments, and is due to the fact of the air acting more effectually on the upper than on the lower part of the fluid. Possibly, also, any globule affected would have a tendency to rise to the surface.

7. I may state that, since making the above experiments, I have been able to examine a specimen of Cheshire milk, such, probably, as that used by Mr. Dancer. This was placed under similar conditions as No. 1, except that for several days the temperature was somewhat higher than what the latter enjoyed. After keeping the Cheshire milk ten days, it showed phenomena agreeing perfectly, except in one particular to be hereafter mentioned, with those presented by the London milk, more especially No. 3 (milk and water). The fungoid filaments of the surface film, although perhaps not so plentiful as in some cases, was yet abundant. So also were the oblong semi-transparent cells evidently connected with it, and which sometimes had the appearance of "sprouting." Many of the so-called oil-globules had altered their form, becoming oval or having a protuberance, the latter phenomenon being the most observable in the lower portion of the fluid, which, however, possessed but few filaments or semi-transparent cells. Some of the globules of this milk, as in other "infusions," much increased in size, while retaining their original form, and they often had a number of smaller ones attached to them. Perhaps to these large globules we must look for the origin of the masses of gelatinous-looking substance which, although developed in all the milk I have examined, was more especially so in this No. 7). Sometimes they take an elongated fibrous form, but without presenting any appearance of cell structure. On the first examination of the Cheshire milk, I noticed numerous bodies like the granular masses found by Professor Brown in milk taken from cows suffering with foot and mouth disease (see No. 1., fig. 2, in SCIENTIFIC OPINION, vol. ii., p. 475). The various figures given by Professor Brown much resemble what I have observed in all the work experimented with as above, after it has been kept for some time. May not the changes undergone by the milk be the same in both cases and due to similar causes?

8. In conclusion, I will refer to a curious series of phenomena which I have met with in the course of these experiments. The effect on organic germs of exposure to great heat is still unascertained, and I determined to try the effect of continued boiling on milk. For this purpose I kept a small quantity of the liquid, in a covered saucepan, on the fire for ten minutes after the first ebullition; but, as I might have expected, the milk at the end of that time was completely dessicated, and there remained only the burnt remnants strongly attached to the bottom of the saucepan. Not to be beaten, however, I scraped off some of this residue and placed it in a bottle about half full of distilled water. On examining this infusion in a week's time, I was surprised to find that it contained animal life in great abundance. Each particle of burnt substance was surrounded by a mass of organic matter, and had attached to it great numbers of small infusoria, which endeavoured, by continual jerking movements, to free themselves. I let this infusion stand for about three weeks longer, and the phenomena it then presented were extremely curious. From many of the masses of burnt matter long filaments had grown, and to these were attached numerous spores or germs, connected by very fine fibres, with a few larger round bodies, resembling somewhat the original milk globules, but, still more, encysted

[1] See SCIENTIFIC OPINION, vol. iii., p. 342.

infusoria. Occasionally, moreover, there were small fungoid stems, evidently due to the union of several oval bodies, and probably forms of the ordinary milk fungus. Among the black burnt particles were several pieces of a lighter colour, which I thought might perhaps be foreign matter. On examining this, however, it was found to present exactly the same phenomena, the whole mass of matter consisting, apparently, of a fine fibrous substance, containing numerous large and small spherical bodies, and having many infusoria attached to it. The filaments were more abundant, and the minuter forms of infusorial life were also more plentiful than in the case of the darker particles of matter. My attention was, however, chiefly attracted by several strange-looking bodies, of irregular form, which I could not understand. On altering the position of the lense, a greater number of them became visible, and I then found that they were, unmistakably, amœbal organisms. I never saw so many of these creatures together before, there being dozens of them within the field of the microscope at one time. They were all of analogous character, and not unlike small forms of *amœbæ princeps*, presenting the club-like protrusions of this organism. The alterations of shape which they underwent often succeeded each other very rapidly. That these amœbæ had come from the mass of burnt matter was evident. They were, as a rule, almost close to it, and might have been squeezed out of it by the pressure of the glass covering placed on the slip. On examining another mass of matter which had been more perfectly dessicated than that just described, several of these organisms were visible in a cleft which divided two portions of the mass. From a third piece of this substance the amœbæ appeared to be issuing while in the field of the microscope. In fact, such an origin for them will alone account for their marvellous abundance. But what explanation can be given of their presence in such a peculiar position? The only suggestion I can offer is that the spherical bodies, of which a great portion of the burnt matter appeared to be composed, were in reality amœbæ *sarcoblasts;* with the figures of which, given by Dr. Wallich,[1] they well agree. This, of course, only half meets the difficulty. The presence of the sarcoblasts in dessicated milk requires also to be accounted for, and this is a question the solution of which it may be as well for me not to to attempt. I may mention that I preserved the slip which showed such an extraordinary number of amœbæ, fastening down the glass cover with asphalte, and on examining it under the microscope I now find that the amœbæ have taken an encysted form; at least, I can find nothing but a number of circular bodies to which to refer them. It should be added, that some of the larger round bodies attached in clusters to the fungoid filaments bore a dark *green* tint, which gives them a very characteristic appearance, and I could fancy that some of the larger infusoria present in the infusion also have this tint. Most of the infusoria are of the same character, a form which I do not recognise as having met with elsewhere. When in a particular position, they have much the shape of *Kolpoda cucullus*, but they are very slow in their movements; and if they turn over, as is often the case, they are then seen to be very broad, and their resemblance to cucullus is lost. It may be as well to state that large bodies, like starch cells, are occasionally to be met with in this infusion, but whence derived I cannot say. These bodies, however, are peculiarly plentiful in an *almond* infusion; with which I am experimenting, and in which, as I expected from the general similarity in appearance, under the microscope, of milk of almond and that of the cow, I have already met with the ordinary milk fungus and the ovate cells with which it is associated.

Royal College of Physicians.—On Saturday night a *conversazione* took place at the Royal College of Physicians, Pall-mall. There was a large attendance of visitors. The company were received by Sir James Alderson, President of the College, and several of its leading members.

[1] See *Popular Science Review* (1866), p. 197.

FILTRATION OF TOWN SEWAGE.

THE new Royal Commission, appointed in 1868 to inquire into the best means of preventing the pollution of rivers, took up the subject where the former Commission had left it,—that is, after the Thames, the Lea, and the Aire and Calder basins had been reported upon, and have now issued their report on the Mersey and Ribble basins. They come to the same conclusions as the former Commission did in respect of the irrigation of land with town sewage being the best means of preventing the pollution of rivers with it, as well as being the most profitable in application; but they state the case in a different way to that in which the former Commission put it. They say that sewage may be sufficiently purified to be allowed to flow into any river or other watercourse, from which it is not intended to take water for domestic use, by *filtration* through sand or porous soil, as distinguished from the view that some persons take of irrigation; which is, that the sewage is purified by running over the surface of the land in a thin sheet, parting with some of its manurial elements to the plants, and storing the remainder in the top soil for the use of the next crop, or rather for the use of the crop first sown after re-ploughing the land; whereas the present Commissioners say that it is the filtration through a sufficient thickness of sand or porous soil that constitutes the efficiency of this method of utilizing sewage; and that, therefore, its purification is insured by passing it through constructed filter-beds equally well as by passing it through the natural soil of the land. This they have ascertained by experiments with several kinds of soil, with sand, and with sand mixed with coarsely-powdered chalk. The difference between filtration through constructed filter-beds and through the soil of the land is one not of efficiency of purification, but of the profitable application of the sewage; the former method being unremunerative, while the latter is remunerative. But it is consolatory to know that in places where land cannot be had for irrigation, the sewage may yet be sufficiently purified to be allowed to flow into rivers, although the solid part of the sewage which is retained may not be of much value. The value of it will evidently depend on the quickness with which it can be extracted in respect of the length of the time elapsing from its entry into the sewers to its extraction at the outfall. Where the gradients are considerable, and the mean distance of the outfall from the town is not very great, it may be arrested in a fresh state; and, mixed with street sweepings and other town refuse, may become of considerable value; while, where the gradients are slight, and the outfall at a greater mean distance from the town, it may become so far decomposed in its transit as to be of no value as a manure.

The Commissioners estimate that, for a town where water-closets are in general use (therefore requiring a larger area than would be required where they are not so numerous), 5 acres of filtering surface, and a depth of material of 6 ft., are sufficient for a population of 10,000. According to their experiments, something of this depends upon the nature of the soil, or other material used for the filter-bed, the qualities of various soils for this purpose differing; for, while soil procured from Dursley in Gloucestershire, purified sewage at the rate of 9·9 gallons per cubic yard per day, soil from Hambrook, near Bristol, did not satisfactorily purify more than 4·4 gallons per day per cubic yard. Again, soil from Beddington purified sewage of the same strength at the rate of 7·6 gallons per day, while that from Barking did not purify it at a greater rate than 3·8, or peat, from Leyland Moss, near Preston, at a greater rate than 4 gallons per day per cubic yard of material.

Considering that "filtration" has already often been employed to purify sewage, and has always hitherto failed, it is rather startling to see it so confidently recommended, until we remember that both the methods of filtration that have failed for sewage also failed for water many years ago; that is to say,

the horizontal method and the upward method; while, as soon as the late Mr. James Simpson rearranged the filter-beds of the Chelsea Waterworks at Thames Bank, many years ago, and made the water to descend instead of ascend through the filtering medium, the question was then and thereafter settled as to whether water should be filtered upwards or downwards. Every engineer since that time—every engineer, that is to say, who has had the knowledge to perceive the difference between a true and scientific and a false and empirical method, or who has had the honesty to acknowledge that he was not the inventor of the practice he has adopted—all these men have adopted the downward system of filtration of water. And so we find the Commissioners—or shall we rather say, Dr. Frankland, one of them?—condemning the system of upward filtration now in practice at Ealing, and giving the reason why downward filtration is so effective in purifying sewage. The system at Ealing is to force the sewage upwards through a filtering medium constantly, thereby effecting no proper purification at all; but, by making the sewage to descend for six or twelve hours through one bed, then shutting it off from that bed, or compartment, and turning it on to another for a like space of time, and so alternately, the descent of the sewage through the interstices of the material on either bed is followed by atmospheric air; the air, that is to say, that occupied these interstices before the sewage began to descend, and has been used up in oxidizing and transforming, and therefore purifying, the former quantum of sewage, is replenished after the descent of each quantum of sewage through each bed; and so, by continual periodical renewals of the proper aëration of the filtering medium, it becomes a constant purifier of the sewage; for, although this method of filtration in the case of water has mostly been called a mechanical one only, yet, in the case of sewage filtration, the same method is said by the Commissioners to be both mechanical and chemical.

In order that there should be no ambiguity about what they recommend, and its attainment, they give a standard of impurity beyond which they think the water of sewage ought not to be admitted into rivers or other watercourses. They suggest that the following liquids be deemed polluting and inadmissible into any stream:—

"Any liquid containing, *in suspension*, more than 3 parts by weight of dry mineral matter, or 1 part by weight of dry organic matter in 100,000 parts by weight of the liquid.

"Any liquid containing, *in solution*, more than 2 parts by weight of organic carbon, or ·3 part by weight of organic nitrogen in 100,000 parts by weight.

"Any liquid which shall exhibit by daylight a distinct colour when a stratum of it, 1 in. deep, is glaced in a white porcelain or earthenware vessel."

So far the standard is applicable to any town. But the Commissioners, having before them the question primarily of the pollution of the rivers Mersey and Ribble, which traverse the manufacturing part of the county of Lancaster, found it necessary for that district to prohibit—suggest, rather, that they should be prohibited—many kinds of pollution peculiar to the manufactures of those parts, *e.g.*:—

"Any liquid which contains, *in solution*, in 100,000 parts by weight, more than 2 parts by weight of any metal except calcium, magnesium, potassium, and sodium.

"Any liquid which contains, whether *in solution or suspension*, in chemical combination or otherwise, more than ·05 part by weight of arsenic.

"Any liquid which, after acidification with sulphuric acid, contains, in 100,000 parts by weight, more than 1 part by weight of free chlorine.

"Any liquid which contains, in 100,000 parts by weight, more than 1 part by weight of sulphur, in the condition either of sulphuretted hydrogen or of a soluble sulphuret.

"Any liquid possessing an acidity greater than that which is produced by adding 2 parts by weight of real muriatic acid to 1,000 parts by weight of distilled water.

"Any liquid possessing an alkalinity greater than that produced by adding one part by weight of dry caustic soda to 1,000 parts by weight of distilled water."

The opinion of the former Commission was that sewage could not be filtered. "As applied to sewage, disinfectants do not disinfect, and filter-beds do not filter," they said. Sewage applied constantly to a filter-bed on the upward system does not purify sewage continually, certainly; and if that was the system meant to be understood, the former Commission were clearly right in their statement, but on the downward system the case is different. Any one who remembers the condition of the Thames when the Lambeth Company took their water from a point of the river near Hungerford Bridge, and when the Chelsea Company took their supply from Thames Bank, may well compare the water then taken from the river for the supply of a large part of London with the town sewage of to-day. The reports of the engineers were constantly that the water was "turbid;" but that word, as now used sometimes to define the condition of the Thames water, conveys no idea of the state of the water at that time. In comparison with the turbidity now sometimes said to exist, it might be called pea-soupy, or sludgy, and yet this very foul water was passed through filter-beds on the banks of the river, after subsidence in reservoirs, and transformed into the brightest and most pellucid water, as drawn from the filtered water-well. No doubt the surface or the filter-beds often required cleaning; the mud deposited soon stopped up the pores of the sand so that no more water would pass, and this necessity of frequent shutting-off and turning-on of the water may have been the cause, as illustrated by the view the present Commission take of the subject, why these filter-beds were so perfect in action under such difficult circumstances; the air filling the interstices of the filtering medium—sand and gravel—after the mud was scraped from the surface of the sand, was replenished at short intervals and so kept the filter-bed continually perfect.

Manchester being within the watershed of the river basin inquired into by the Commission, it became necessary for them to institute an inquiry into the merits of the privy and ash-pit system, as against the water-closet system, especially as that city is the great stronghold of this first-named system.

Agreeing with every other impartial inquiry into this subject, the present Commission condemn it. They illustrate the case in a remarkable way. They suppose all dwelling-houses, warehouses, &c., to be removed, and only the privies left—nearly 60,000 of them in Manchester and Salford—rows and streets, and crowds of them—scattered about almost as thickly in places as the heaps of manure upon a field that has just received a dressing from the dung-cart—each heap here, however, no mere barrowload once a year, but a constant collection and continual soakage of filth, which has for years been polluting every corner to which air or water could have access. *Is this the site on which to build a healthy town?* Would it not be the first desire of every sensible man to sweep this filth away, to drain and aërate, and, if possible, to sweeten this land before a single dwelling-house should be built?

On the great question of establishing a River Conservancy Board, the present Commissioners agree with the recommendations of the former Commission, to the effect that it is highly desirable that such a Board should be established for every river basin; but on the secondary question of how, and of whom it should be constituted, the chairman, Sir W. Denison, does not agree with his colleagues, Dr. Frankland and Mr. John Chalmers Morton, and on that subject they give separate reports. The chairman advises a parochial system; that the officers of such parishes as the stream flows through should be the persons responsible for the state of the river flowing through their respective districts; but, anticipating abuse of the powers placed in their hands, he recommends that they be made sufficiently responsible to the general government to enable the latter to check or prevent any such abuse, or to notice and reprove, and even to punish, all negligence or unfairness in the

mode of action of the former. The initiation of action is to be the complaint of neighbour against the conduct of neighbour.

Let us take a supposititious case, and inquire how this would be likely to work in practice. Suppose two of the uppermost mills or towns on a stream to use the water that comes to them with satisfaction to themselves, but that one or both of them foul it so as to be unsatisfactory to the third person or town, the one below them. Of whom is the third party to complain? And, of course, the difficulty is increased if three or more parties are satisfied, and the fourth or fifth complains. The boundary of the district over which each parochial Board is to have jurisdiction being coterminous with that of the parish, how are the officers of the parish injured to determine who above them has caused the injury? If all are complained against, who shall determine the degree in which each has contributed to the pollution of the river?

Dr. Frankland and Mr. Morton recommend that, inasmuch as there exist at present no local bodies competent to deal with questions connected with efficient river conservancy, capable of detecting pollutions and enforcing remedies, it will be necessary to call into action an authority possessing greater capacities and powers than those of the existing corporate bodies or local boards. The duties of this authority would be of two distinct kinds: the one would be those of a river police, employed in the detection of offences, and in obtaining the conviction of offenders; the other would include the investigation of and decision upon various works connected with rivers, proposed by either towns or individuals, such as schemes for water supply, and for the defecation, filtration or utilization of sewage and other polluting matters, while local boards could obtain information on these points only from persons capable of investigating them. Nevertheless, under the second division of the duties of the central authority, the co-operation of the local corporations would be required for the efficient discharge of them. Indeed, if guided and assisted by a properly qualified central court, the present local boards would be quite competent to meet all local difficulties and to supply all local wants. A central authority would not extinguish the corporations and local boards at present existing in the river basins. It would, the Commissioners believe, materially promote the energy of local action, by removing the obstacles which at present hamper it, and by giving a prompt decision to the questions which it has to solve.—*The Builder.*

THE EFFECT OF POWERFUL MAGNETS ON MAN AND THE LOWER ANIMALS AND PLANTS.

BY JOHN VANSANT, M.D.,

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IN THREE PARTS.—PART III.

COMMENT on the foregoing experiments upon animals appears almost unnecessary, since, when carefully considered, they seem to be able to produce no other conviction in the mind than that the phenomena observed were caused by the power issuing from the magnetic poles. That there is a power emanating from the magnet we *know*. Approach it to some substances, they are attracted; to others, they are repelled. A mass of inert, unorganized, dead iron, submitted to this power, springs, as it were, into life, moves bodily against gravity, and at the same time *alters its form*. Living beings have the ability to move against gravity, and change their form by virtue of a power elaborated within themselves. But, in both cases, the original source of the power exists in, and is communicated from, something external to the moving body. A magnet is a palpable agent, containing (as we seem bound to believe) a subtle *thing* (be its motion vibratory, or otherwise)—magnetism—which, we now see, can be employed, not only to infuse a kind of *life* into ordinary dead matter, but to arrest the life already existing in living matter.

Coming, now, to experiments performed on the *human* subject, to discover and exhibit the effects of magnetism, I find it impossible to give, within the limits assigned to this paper, the details of a sufficient number of cases to show the *grounds* for my conclusions. Nor is this at all necessary; because, by grouping together in a tabular form the symptoms I have observed in a large number of trials to follow each form of appli-tion, the whole will rest upon the same authority as if every case had been separately reported in full; and that when the general mode of experimenting is explained, and particular directions given for placing the respective magnetic poles, any one who desires to repeat the observations has the *data* for so doing. Still, it may not be out of place to relate very briefly a few cases, as examples, to show that magnetism, being applied in an abnormally sensitive state of the system, manifests its effects more quickly and obviously than in a condition of health.

Experiments upon Human Beings.—1. Mr. J. R., a gentleman of rather delicate organization, had neuralgia in the upper part of one side of his face. I applied the northward (—) pole of a small bar magnet, not quite capable of lifting half an ounce with one pole, for a few seconds, over the painful place. In about ten minutes he said the pain was increased and more localized. I then applied the southward (+) pole in the same way, and in a few minutes he said the pain had nearly ceased. This gentleman *expected* to be relieved by the *first* application.

2. Mr. M., a strong, unimaginative man, had facial neuralgia of malarial origin. I applied the — pole of the same small magnet last described over the seat of pain for about one minute. In five minutes he complained of the pain being worse. I then made an application of the + pole, and in less than a minute the pain almost subsided. After about an hour there was a recurrence of pain for a short time, but much lessened in intensity. This person, also, was led to *expect* relief by the *first* form of application. (I have repeated the above experiments on myself, with similar results.)

3. Mrs. S., a lady of remarkable sensitiveness, but great self-control, was suffering from excruciating neuralgia of the nerves passing out of the left side of the pelvis. The day before I had injected subcutaneously, near the painful place, one-fourth of a grain of sulphate of morphia, with the effect to produce very great depression of the vital powers, but not to relieve the pain, which continued to be felt during the semi-consciousness that followed. On this occasion, without any knowledge on the part of the lady of what I was doing, I passed slowly, for about ten seconds, over the upper third of the thigh, the — pole of a strongly magnetized steel rod, 4 in. long by one-third of an inch diameter. The effect was surprising and alarming. The pain shifted its position, became more diffused and higher up, but was not relieved. A kind of stupor intervened, her respiration was oppressed, a death-like pallor overspread her countenance, her features became contracted, her eyes sunken and half-closed, the heart acted feebly, and the surface of the body was cool and covered by clammy perspiration. The depressing effect much resembled the action of morphia on the previous day, but was even greater. All these symptoms were manifested within a few minutes. After waiting about fifteen minutes I applied the other pole—the + one—for the same length of time to a spot a little below the hip-joint, and in a short time new symptoms were manifested. The pain was apparently increased and more localized, the extremities remained cool, but the perspiration was checked, the breathing was deeper, the eyes closed naturally, and all the signs of depression began to vanish.

In the above instances of disease, the real action of the magnetic force on the economy is not, probably, any greater or more speedy than in health; but when the equilibrium of the vital forces has already been disturbed, there would seem to be less resistance offered than when the perfect balance exists.

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Nevertheless, a careful inspection of the groups of symptoms in the subjoined table, *which are those capable of being produced by magnetism when applied to the body in health*, will show that there is hardly a function of any organ that is not more or less affected, though the action appears to be observable chiefly by its effects on the ganglionic nervous system, and, through that, on the various organs.—*The (American) Journal of Psychological Medicine.*

ADDITIONS TO THE MENAGERIE OF THE ZOOLOGICAL GARDENS, REGENT'S PARK.

From June 12th to 18th, 1870.

Name.	Country.	How obtained.	Where placed in Gardens.
1 Occipital Lizard (Cyclodus occipitatis)*	North Australia	Presented by Dr. E. Schomburgh	Reptile-house.
2 Australian Sacred Ibises (Ibis strictipennis)	Australia	Ditto	Lawn Pond.
2 Black and White Geese (Anseranas melanduras)	Australia	Ditto	Ditto
1 Raven (Corvis Corax)	British Islands	Presented by the Rev. J. H. Gosset	Parrot-house
1 Lanner Falcon (Falco Lanarius)	Algeria	Deposited by J. H. Gurney, jun., Esq., F.Z.S.	Falcons' Aviary.
3 Hybrid Foxes (between C. argentatus ♂ and C. Vulpes)		Born in the Menagerie	Small Mammal House
1 Nicobar Pigeon (Colœnas Nicobarica)		Hatched in the Gardens	Western Aviary
1 Andaman Monkey (Macacus leoninus) ♂	Andaman	Purchased	Monkey-house
1 Philantondia Antelope (Cephalophus Maxwellii)	Sierra Leone	Presented by John Reeves, Esq., F.Z.S.	Gazelle Sheds.
1 Macaque Monkey (Macacus cynomolgus) ♀	India	Ditto	Monkey-house
1 Maned Goose (Bernicla jubata)	Australia	Purchased	Lawn Pond.
1 Chestnut-breasted Duck (Anas punctata)	Ditto	Ditto	Ditto
1 White Goshawk (Astur Novæ Hollandiæ)	Ditto	Ditto	Falcons' Aviary.
1 Short-eared Phalanger (Phalangista cavina)	New South Wales	Ditto	Small Mammal House.
1 Great Blue Kangaroo (Macropus cærulescens)*	Queensland	Ditto	Kangaroo-sheds
1 Lacertine Snake (Cœlopeltis Lacertina)	Africa	Ditto	Reptile-house
1 Viperine Snake (Tropidonotus viperinus)	North Africa	Ditto	Ditto
2 Horse-shoe Snakes (Zamenis hippocrepis)	North-West Africa	Ditto	Ditto
1 Hooded Snake (Coronella cucillata)	Ditto	Ditto	Ditto
2 Ocellated Skinks (Gongylus ocellatris)	Ditto	Ditto	Ditto
3 Skinks (Heteronceles)*	Ditto	Ditto	Ditto
1 Fan-footed Gecko (Ptyodactylus gecko)	Ditto	Ditto	Ditto
3 Aldrovand's Lizards (Plestiodon auratum)	Ditto	Ditto	Ditto
1 Jelerang Squirrel (Sciurus bicolor)	India	Purchased	Small Mammal House
3 Horned Lizards (Phrynosoma cornutum)	Indianola, Texas	Presented by the Rev. L. Glynn	Reptile-house.
2 Peba Armadillos (Dasypus Peba)	Buenos Ayres	Presented by Mrs. Mackinlay	Ant-eaters' House.
1 Lunulated Monkey (Cercocebus lunulatus)	West Africa	Presented by F. Van Zeller, Esq.	Monkey-house.
5 North African Jackals (Canis anthus)		Born in the Gardens	Civet Cats' House.
4 Black-breasted Peewits (Sarciophorus pectoralis)	Australia	Purchased	Western Aviary
2 Common Chameleons (Chameleon vulgaris)	North Africa	Ditto	Reptile-house.
1 Squirrel Monkey (Callithrix sciureus)	The Amazons	Presented by C. W. Newall, Esq.	Monkey-house.
1 Black-faced Kangaroo (Macropus melanops)		Born in the Menagerie	Kangaroo-sheds.
5 Barred-tailed Pheasants (Phasianus ravesii)		Hatched in the Gardens	Pheasantry
2 Purple Kaleegos (Euplocamus Horsfieldii)		Ditto	Ditto
3 Black-backed Kaleegos (Euplocamus melanotus)		Ditto	Ditto
1 Yellow-billed Duck (Anas scanthorhynchus)		Ditto	Round Pond.

♂ Male. ♀ Female. * Never Previously Exhibited.

A LABORATORY OF EXPERIMENTAL RESEARCH.

BY PROFESSOR ALBERT R. LEEDS.

ONE of the most important services rendered by the great Swedish chemist to his beloved science was that he freed it from its previously-attendant mystery and discomfort—its dirt and gloom. The cold outbuildings and damp stone floors, hitherto thought proper for destructive acids and noxious vapours and dangerous furnace-fires, were too unwholesome to be endured through the protracted severities of a Swedish winter; and so Berzelius carried his crucibles into comfortable rooms in his own dwelling, made the clumsy furnace yield to his convenient lamp, and made chemistry a science most cheerful and domestic. Among the young chemists, who were attracted by the splendour of his discoveries to the home of Berzelius was Henry Rose. When, later in life, Rose became Professor of Chemistry in the University of Berlin, he also devoted two or three small rooms in his own house, and admitted to them a few students, who came, highly recommended for their skill and chemical knowledge, to work out analytical methods under his direction. Among them, and for several years his assistant, was Dr. Finkener, recently appointed Professor of the Berg Schule in Berlin. This Berg Schule occupies the Old Bourse, and the chemical laboratory is the large hall in which the bankers of Berlin were wont to assemble before their present magnificent Bourse upon the opposite side of the Spree was erected. The assiduity, care, and ingenuity which Dr. Finkener *has displayed* in the last, the sixth, and in former editions of Rose's great work on Analytical Chemistry, has given him a familiarity with analytical processes which has rendered him deservedly successful and popular as a teacher. To an American, the fees in the Institution appear incredibly small. For the daily use of the laboratory for five months, including gas, chemicals, and apparatus, the charge is twenty thalers (about twenty dollars in currency at the present time). Nor is this economy obtained at the sacrifice of those facilities which the student may reasonably expect in the present advanced state of chemical science. One or two agate mortars, a couple of steel mortars, the cork-borers, files, and other simple tools, the sand and water baths, &c., are the property and for the use of all. The students enforce the police regulations, and keep the laboratory in order. The apparatus for the evolution of sulphuretted hydrogen, carbonic acid, and hydrogen is arranged by an assistant; and the time of the student is not consumed in preparing these contrivances for himself: the same remark applies to the apparatus for the manufacture of chlorine, hydrofluoric acid, the determination of carbonic acid, nitrogen, &c.; to the burettes and

and standard solutions for volumetric analysis. In desk-room the student is limited, though not hampered for want of space. Of hood-room there is more than sufficient for all the evaporations and operations detrimental to health, which the students are likely at any one time to be carrying on. How different from one of the largest of our American laboratories, where the regular charges are 100 dollars per term, and the incidental amount to a very considerable sum. Each student is required to consume time and money in constructing a sulphuretted hydrogen, carbonic hydrogen, and other apparatus for himself; and, without he consumes more of both than most can afford, his apparatus, when completed, is inadequate to accomplish nice work or obtain accurate results. In respect to size and completeness, the laboratory of the Berg Schule at Berlin is much superior to that of the Mining School at Freiburg, now, and for many years past, under the direction of Professor Sheerer: the rooms are small, dark, and ill-provided with gas and apparatus.

Since the calamities which have fallen upon the kingdom of Saxony, the places of such as Breithaupt and his illustrious co-labourers have not been filled by men of equal renown; and the ancient glory of the Institution is departing. The student still goes to see the great cabinet of minerals accumulated by the father of Geology and his successor, and still may obtain excellent practical instruction in the determination of minerals. Here, as at some other places in Europe, and in our own country, where mineralogy is successfully taught, fragments of crystals are put into the hands of students, and they are expected, under the eye of the teacher, to determine their hardness, cleavage, and crystalline form. Their attention is directed to the peculiarities of surface condition, optical properties, &c.; and they are taught to substitute critical examination for slovenly guesswork. The fiery enthusiasm with which the old Professor of Metallurgy performs his duties still attracts students, who have finished their studies at other schools, to Freiburg for this special course; and nothing, certainly, can be more gratifying than the zeal with which the lynx eyes of the professor follow the assay from the incipient stages of the preparation, through the blazing furnace, to the triumphant moment when the button emerges into view. The metallurgical apartment at the Ecole des Mines in Paris is more imposing in appearance: with its practical working I am not so well acquainted. The Free Laboratory in the Jardin des Plantes is adapted only to elementary work; that at the Ecole Centrale is dirty and dismal; and that of the Sorbonne, which was erected at about the same time as the great Frederick Wilhelm Laboratories at Bonn and Berlin, is not comparable to either in size, elegance, and completeness. In the latter of these two noble edifices, the beautiful lecture-room is provided with a special laboratory for the preparation of lecture experiments, and also a museum of such minerals, apparatus, models, and metallurgical and industrial products as are useful in demonstration or illustration. Between the spacious apartments for qualitative and quantitative analysis, there is a room devoted to the preparation of reagents. There are also separate apartments set aside for metallurgic and pharmaceutical processes, weighing-rooms, a library, a room for organic analysis, and one for students engaged in original investigation.

There is no provision, however, for the prosecution of researches in physics, and but scanty accommodations to workers in physiology. Professor Magnus, of the University of Berlin, has devoted a few rooms in his dwelling to physical research; and, while I was engaged there, three other students were present—one occupied by an investigation in acoustics, another in polarized light, and a third in the measurement of crystals of recently-discovered chemical compounds. A laboratory of physics is greatly needed at the present time in our own country. The teachers of natural philosophy in our colleges have little opportunity for fitting themselves by a course of special training for their duties, and are seldom able to make or improve their apparatus, or to enter with success into experimental research. A chemist is able to effect little who has not acquired, by years of practice, skill in the conduct of analyses. So, too, other things beings being equal, he will be the most successful physicist who is the best mechanician. In such an institution the mechanical ought to advance with the mathematical education; and, while the pupil is studying mensuration, he might be mastering the turning-lathe; and, while applying calculus to optics, in grinding and mounting a lens. We do not advocate such an education only for those who design to be physicists by profession, but regard it as best adapted to develop many minds, and to bring forth a kind of talent eminently useful. Where shall the civil engineer, the miner, or the architect get such an education at present? Yet, to all these men, the ability to construct as well as to plan a house, machine, or engine, would be of inestimable value. Moreover, a long course of theoretical instruction alone is dry, and oftentimes disheartening, especially to those who, with great native ingenuity and mechanical skill, have little facility in mathematics. Such a physical laboratory should have a carpenter's shop, with tools for all kinds of joinery and turning; a machine-room, with furnace, bellows, anvils, vices, lathes, &c., and a room for finishing apparatus and the nicer kinds of work. Under the conduct of skilled mechanics, the students might be taught to make the apparatus requisite to demonstrate the principles of natural philosophy; and, when they were prepared to undertake researches of their own, or to take their degrees as engineers, they would be able to cope with the practical matters which would occupy their time and energies. Besides the workshops, there should be separate rooms in a laboratory of this description, devoted to researches in heat and optics, including spectrum analysis, photometry, microscopy, and crystallography; to acoustics, electricity, and magnetism, and to the problems of engineering. We believe that there are many young men to whom an education of this kind would prove more attractive than any now obtainable, and that the practicable benefits, as well as the scientific results, of such an institution, would be very great.—*Journal of the Franklin Institute.*

ON AN EARLY TELESCOPE MADE BY GIUSEPPE CAMPANI, OF ROME.

BY JOHN WILLIAMS, ASSISTANT SECRETARY TO THE ROYAL ASTRONOMICAL SOCIETY.

AT the sale of the late Dr. Lee's instruments, a few weeks since, I purchased an Italian telescope, which, appearing to be of considerable interest as an example of an early instrument by a then eminent maker, I trust I may be excused calling attention to it.

On examination I found it to be one constructed by the celebrated Joseph Campani of Rome, who was considered as the best maker of telescopes of his day. Thus we find Cassini and other eminent astronomers of that time employing instruments made by Campani in their astronomical researches.

I have been unable to find any satisfactory biographical account of this able artist, and can only ascertain that he flourished about the middle of the seventeenth century.

Weidler, in his *Historia Astronomiæ*, 4to., 1741, speaks very highly of Joseph Campani, and particularly notices his observations of Saturn and Jupiter, as well as his excellence as a maker of telescopes. As the quotation from Weidler is rather long, and is in Latin, I shall content myself with the summary of his statement by Dr. Long, as given in his *Treatise on Astronomy*, 4to., 1785. His words are, "About this time also (1641) Joseph Campani at Rome applied himself to the grinding of glasses for long telescopes, which far excelled all others of that time. Through the munificence of Louis XIV. Cassini had some made by this artist of 100 and 200 palms. Campani saw the shadow of Saturn's ring upon his body, as also his zones or obscure belts, and detected the shadows of Jupiter's

satellites in passing over his body. It was with one of Campani's telescopes that Cassini first saw all the satellites of Saturn." Weidler adds, "Longiora quidem telescopia Campanus pauca fabricavit, in quibus, pro coloribus arcendis, tria vitra ocularia adhibuisse dicitur; attamen etiam breviora quæ composuit, 15, 20, 30 pedes longa, singulari perfectione prædita erant, ut ceteris similibus antecellerent." Which may be rendered, "Campani also made a few longer telescopes, in which to neutralise colour, he is said to have applied three glasses in the eyepiece; and the shorter telescopes made by him of 15 ft., 20 ft., and 30 ft. in length, were of such extraordinary perfection that they greatly surpassed all others of the same kind." It is also stated that "the Royal Academy (of France) are said to have had excellent telescope glasses of this artist's making which were of 200 ft. and 300 ft. focus, and magnified four or five hundred times." In the *Speculum Hartwellianum*, Admiral Smyth mentions this very instrument as "an old one deserving notice for its respectable age and its tolerable performance."

The telescope to which your attention is now called is one of the shorter ones fabricated by this excellent maker, it being but from 9 to 10 ft. in length. The object-glass is 2 in. in diameter, reduced by a diaphragm to 1½ in. and is ¼ in. in thickness, on it is written with a diamond, "Giuseppe Campani in Roma," and the glass of which it is composed is of excellent quality. The eye-piece consists of three plano-convex lenses, the glass of which is of equally good quality, that nearest the eye being fixed and the other two reversible. There are inscriptions in Italian relating to these glasses, one of which reads as follows—"Quando questa parte sta dentro al cannello si vede l'oggetto piu chiaro," *i.e.*, when this part is placed within the tube the object is seen clearer. The second is in the same words, excepting that "piu grande" occurs instead of "piu chiaro," implying that the power is increased. One of the Fellows of the Society (Mr. Buckingham), who is well acquainted with telescopes, has tested these powers, and estimates the lower one at about 20 and the higher at 25 times. Upon taking this portion of the eye-piece away altogether, the telescope becomes an astronomical one, and is much increased both in power and clearness. There is also on the eye-piece a nearly obliterated inscription, evidently relating to its use for astronomical purposes, together with the letters PALI. XII., which appear to refer to the focal length as being 12 Palms. The Roman Palm is about 9 inches. This would give 9 feet as the focal length, which closely approximates to the truth. The case is composed of nine tubes formed of vellum, which are remarkably strong and light, the whole weight being but 2 lb. 11 oz. These tubes draw out in a manner similar to that employed in telescopes of the present day. When closed it is about 2 ft. in length, but draws out to about 9ft. when in focus. The workmanship of the whole is exceedingly good.

When it came into my hands it had evidently not been drawn out for many years, and I had great difficulty in extending it to its full length. The glasses also were encrusted with the dirt of years, and required careful cleaning.

In the absence of a better test, I turned it on the word "Admiralty," on the opposite side of the quadrangle of this building (Somerset House), and was very favourably impressed with the sharpness of its definition and the flatness of the field. I have since viewed the moon through it; and, considering the low power, was much gratified, and, indeed, surprised, at the excellence of its performance; the lunar craters appearing, with all the powers, sharp and well defined, and the ragged edge very beautifully shown. The field of view is, however, small, and the instrument rather troublesome to use on account of its length, as, unless very carefully handled and adjusted, the flexure occasioned by the want of suitable support interferes somewhat with its efficiency. With the requisite care, however, it acts very fairly, and I have no doubt, if properly mounted, its performance would be very satisfactory.—*Monthly Notices.*

CYPRIPEDIUM LOWII.

THE beautiful *Cypripedium Lowii*, of which a woodcut figure is annexed, was introduced from Borneo by Hugh Low, Esq., to the Clapton Nursery, about 1846, and was described in 1847 by Dr. Lindley, from specimens which bloomed in the garden of A. Kenrich, Esq., of West Bromwich. In its native habitats it was found growing on high trees in thick jungle, and bearing its flowers in April and May. Our figure was prepared from specimens which bloomed in the nursery of Messrs. Veitch & Sons last February.

Cypripedium Lowii is a stove herb, with leathery, oblong-ligulate, obtuse, emarginate, yellowish-green leaves. The scape is downy, and of a dull purple, and bears usually three or four flowers, though it would appear from Dr. Lindley's description that as many as eight are sometimes produced. The dorsal sepal is downy outside, dull pale green within; the petals are spathulate, twice as long as the lip, green, marked with distinct brown purple spots on the lower half, wholly dull purple above, the margin ciliated; and the lip is smooth and shining, of a dull brown, with a purplish tinge, bluntly oblong, *notched in front*, and having two bluntish ascending lobes, and behind each a triangular tooth. The sterile stamen is obcordate, with a triangular tooth in the apical sinus, and a central horn at the opposite end, both the horn and the edge bristling with purple hairs.

This species has been introduced in large quantities during the last few years, but it is somewhat difficult to establish and consequently will never become over abundant. Nor is it, indeed, a matter of wonder that so many of these plants refuse to grow, if we take into consideration the great length of the journey, and the excessive heat of the latitudes through which they have to travel, for as they have no pseudobulbs to act as storehouses of nourishment, the roots and leaves are in most instances dried up to such an extent that very little vitality remains in them by the time they reach this country. Hence, on opening the boxes, death is too often found to reign supreme, though occasionally, to the great delight of lovers of this beautiful species, a consignment arrives in excellent condition.

When first taken in hand, the plants should be placed in moderate heat, and in a moist atmosphere, very little water being given, and great care being taken that none is allowed to remain in the heart of the plant. After they are established, a liberal supply of water may be given, both from watering-pot and syringe. The temperature of the East Indian house will be necessary. The soil should be fibrous peat and sphagnum moss, in equal proportions, adding a little silver-sand, and some small pieces of charcoal. It is of the utmost importance always to drain well.—*The Florist and Pomologist.*

RECENT ADVANCES IN ELECTRIC SCIENCE.

BY C. WIDEMANN.

Ney Electric Battery.

THIS battery is composed of a vessel containing hydrochlorate of ammonia in saturated solution with an amalgamated zinc-plate plunged therein; also a porous cup filled with carbonate of copper, having a copper plate plunged into it.

This new battery can be established at little cost; and, in order to maintain its power, it needs only a few pieces of sal ammonia added from time to time.

The carbonate of copper is insoluble in the solution of hydrochlorate of ammonia; but, in closing the circuit, the hydrochlorate of ammonia decomposes into hydrochloric acid and ammonia, the first going to the zinc pole and the other to the copper pole; the carbonate of copper becomes then soluble, and its solubility produces a secondary current of the power of a Daniell's battery.

CYPRIPEDIUM LOWII.

For military telegraphic purposes, in order to render this battery transportable, the solution of sal ammonia can be replaced by sand impregnated with the same solution.

Devo's New Electric Battery.—This very simple battery has been quite lately adopted by the Belgian telegraphic administration to work on an important line. It consists in a cylindric vessel, divided into two parts by means of a piece of gas carbon. In one of the parts a mixture of pulverized sal ammonia and coke is placed, and in the other part a zinc plate.

This battery is set in operation by adding pure water to the two compartments. The zinc decomposes the ammoniacal solution to form chloride of zinc. The positive pole corresponds to the graphite blade, and the negative to the zinc blade.

This battery is more powerful than the sulphate of copper battery.

Secondary Battery of Gaston Plauté.—When the two metallic plates which have been used to decompose water by a battery are joined together by a conductor, a secondary current is obtained, called the current of polarization.

The intensity of this current varies according to the substance of which the plates are made, and its maximum action takes place when leaden plates are used.

This last property has been discovered by Mr. Gaston Plauté, who has constructed a battery in which he takes advantage of this polarization current.

A gutta-percha cup, of a parallelopipedic form, contains six lead plates, separated from each other by a free space, and the even-numbered plates are put into communication with one of the conductors, and the odd-numbered plates with the other conductor. The gutta-percha cup contains water acidulated by sulphuric acid.

In attaching to the two conductors the rheophores of a small Bunsen battery, the current passes through the acidulated water and decomposes it. The positive leaden blades, where the oxygen is sent, are very soon coated with binoxide of lead. This latter having a great tendency to decompose water by its avidity for hydrogen, which action is the reverse of the electrolytic action, it happens then very soon that the decomposition of the water into its two elements, hydrogen and oxygen, ceases very rapidly.

Then, suppressing the Bunsen battery, and rejoining the conductors to which the two systems of lead blades are attached, a current of a larger intensity than the one formerly used is obtained.

In using two lead electrodes having a double surface of 2 square mètres, Mr. Planté has obtained similar results to those produced by 70 Bunsen cups of 8 in. in height.

With the six leaden blades (having a dimension of about 20 to 22 centimètres) of the battery we have just described, a large steel knitting-needle is melted by having this polarization current passed through it.

To obtain results of quantity and tension as desired. Mr. Planté disposes near each other forty gutta-percha cups, containing the acidulated water, in which twenty lead plates, about $7\frac{1}{2}$ in. square, are dipped. These blades are joined, as above described, by even and odd numbers, and the battery is worked as described to obtain the results of quantity; but to obtain the results of tension a peculiar commutator is used, joining together the lead blades in the following order:—No. 2 with 3; No. 4 with 5; No. 6 with 7, &c.

In joining the two extremes, a current capable of an enormous resistance is obtained, enabling a platina wire of 2 mètres in length and $\frac{1}{4}$ of a millimètre in diameter, to be brought to a red heat. An iron wire burns immediately, and an intense light is obtained from a metallic point over a surface of mercury; also in putting in contact two carbon points.

As it has been seen, this secondary battery is to the battery which charges it what the Leyden jar is to the ordinary electric machine.—*Scientific American.*

ON THE DESCENT OF GLACIERS.

BY THE REV. HENRY MOSELEY, M.A., F.R.S., CANON OF BRISTOL AND INSTIT. IMP. SC. PARIS CORRESP.

IN TWO PARTS.—PART I.

GLACIERS do not take their origin in the highest Alpine regions. It is not there that the snow chiefly falls, but on a belt girding them below. This wide belt is divided horizontally into an upper and lower part by the snow-line, at a height of from 3,000 to 3,300 yards. Above that line snow always lies, and rain very rarely falls; beneath the snow-line the snow disappears every summer, and rains are abundant. It is from this belt about the snow-line that the glaciers are seen emerging. They lie like huge slugs along the descending valleys, swelling themselves out to fill their channels where they are wide, and thinning themselves to pass through the gorges and narrow places in them. They seldom come down to a lower level than 1,100 yards. Between this level where they end and the snow-line, 3,100 yards high, where they begin, they traverse sometimes a very long space—lying for the most part at a low pitch. The resemblance to a huge mollusk is kept up in *this*, that they move with a strange slow motion, not altogether unlike that of such an animal. The parallel will be complete if we conceive the mollusk to have its tail continually renewed as it withdraws it from under the snow-line, and its head continually melted away as it thrusts it forward below the level of from 1,000 to 1,400 yards. If we further imagine the steep sides of the valley through which the glacier descends to have similar but smaller glaciers crawling down them to the principal glacier, we shall understand what is meant by tributary or secondary glaciers, which are *thus* placed in regard to the principal ones; having a far greater pitch or slope than they, and flowing into them like tributary streams to a river. The slope of a principal glacier is often as little as 3°, and yet it may move with a velocity of 24 in. a day. The slope of a tributary glacier is sometimes 50°, and it may not advance more than 4 or 5 in. a day at the most.[1] Masses of rock of different sizes, from huge boulders to stones, are constantly broken by the frost from the sides of the valley of the glacier, and are carried slowly down on its back to the level where its head melts away, and there are deposited. These are called moraines. They lie along the course of the glacier in ridges, protecting the ice beneath them from the sun's rays. That ice does not, therefore, melt as the rest of the ice does, and so it forms a ridge of ice. A moraine is, therefore, a ridge of stones standing on a ridge of ice.

The descent of a glacier is not a descent of the whole together, or bodily, like that of a block of stone. There is an internal descent of every particle in the glacier over and alongside of every other particle. If a plane section be imagined to be made across it, the particles of ice passing through that cross-section at any given time must be conceived to be all moving at different rates, so as to be sliding over and beside one another; the particles at the surface moving faster than those below, and the particles near the centre moving faster than those at a distance from it, exactly as the particles of a stream of water move.

The existence of this differential motion is strikingly seen in what is called the veined structure of glaciers. This veined structure appears first to have been described by M. Guyot, in the year 1838. The following is his account of it, as he saw it on the glacier of Gries, which I translate from the work of M. Huber:—

"I saw under my feet the entire surface of the glacier covered with furrows an inch or two wide, cut in snowy ice, and separated from one another by ridges of harder and more transparent ice. It was evident that the mass of the glacier was here formed of these two different kinds of ice: the former (that of the furrows) was white and melted more rapidly; the other (that of the ridges) was more perfect, crystallized, transparent, and hard. The unequal resistance to melting of these two kinds of ice was the obvious cause of these depressions and elevations. After having followed them for several hundreds of mètres, I reached a crevasse 20 or 30 ft. wide, which, cutting the furrows at right angles, exhibited, down to the depth of 30 or 40 ft., an admirable transverse section of this structure. As far as my eye could reach, I saw the mass of the glacier composed of layers of the [opaque] white ice, separated from one another by layers of the transparent ice, the whole forming a mass as regularly stratified as certain calcareous rocks." *This is the veined structure of glaciers.*

[Canon Moseley's remarks on the differential motion of glaciers, with special reference to the observations and experiments of Forbes and Tyndall, illustrated by diagrams, will be found in the *Philosophical Magazine* for April, 1870.]

The effect of the differential motion in *separating* and *distributing* the parts of a glacier has been shown in various ways. The remains of the guides lost in 1820, in Dr. Hamel's attempt to ascend Mont Blanc, were found imbedded in the ice of the Glacier des Bossons in 1863. "The men and their things were torn to pieces, and widely separated, many feet. All around them the ice was covered in every direction, for 20 or 30 ft., with the hair of one knapsack, spread over an area three or four hundred times greater than that of the knapsack. This," says Mr. Cowell, from whose paper, read before the Alpine Club in April, 1864, I have made the quotation, "is not an isolated example of the scattering that takes place in or on a glacier; for I have myself seen on the Glacier of Theodule the

[1] The motion of the Gtunberg, a tributary of the Aar glacier, inclined at 30° to 50°, was found by Desor to be 22 mètres a year, while that of the Aar glacier, inclined at 40°, was 77 mètres.

remains of the syndic of Val Tournache scattered over a space of several acres."

Whatever the force may be which causes the descent of glaciers, it must be chiefly expended in this constant displacement of the particles of the ice over one another and alongside one another, of which the veined structure affords the evidence, and to which is opposed everywhere that force of resistance which is called *shearing* force. By the property of ice called regelation, when any surface of ice so sheared is brought into contact with another similar surface it unites with it, so as to form of the two one continuous mass. This may be shown by experiment. If a cylinder of ice be placed in an apparatus suitable for the purpose, and slowly sheared partly across, the new surfaces continually being brought in contact with one another in the act of shearing will not present the slightest appearance of separation, the ice being *there* as continuous as elsewhere, its molecules entering into precisely the same relations to one another in their new positions as they did in the positions out of which they have been sheared. Thus, a slow displacement of shearing, by which different similar surfaces of ice in a glacier were continually being brought into presence and contact with one another, would exhibit all the phenomena of the motion of glacier ice.

The late Principal Forbes calculated that in the Aar glacier the shearing displacement amounts to $\frac{3}{14}$ths of the whole displacement of the glacier. The sliding displacement of the whole glacier bodily on its bed is, in comparison with it, unimportant as it regards the expenditure of force requisite to bring it about. The differential motion is the *great* and *characteristic* phenomenon of the descent of glaciers, but it is that, in assigning an adequate cause for which, existing glacier theories loom to me most conspicuously to have failed.

The Swiss philosopher De Saussure was the first to study the descent of glaciers with care, and wrote on it about sixty years ago. He held that glaciers slip down the slopes on which they rest by their weight, just as other bodies slip down inclined planes. This explanation is simple, and was generally accepted as long as it was thought that glaciers slipped down bodily like blocks of stone would, with an equal motion of all their particles; but when the internal motion of their particles upon one another, like that of running water, came to be discovered, and when it was found that the high-pitched tributary glaciers moved slower than the low-pitched principal ones, this theory was brought into doubt, for it was in direct contradiction to these facts.

M. Rendu, the Bishop of Annecy, considered the descent of a glacier to be so like that of a fluid that it was impossible to explain it otherwise than by supposing ice actually *to be a fluid* and not the *solid* thing it seems to be. He was the founder of the celebrated viscous theory of the descent of glaciers, advocated with such remarkable energy, industry, and ability by the late Principal James Forbes, whose various works on glaciers have exhausted the whole field of observation, and supply most of the facts on which the true solution of the problem, whenever it is arrived at, must be founded. When, however, at another stage of the inquiry, it came to be discovered by Faraday and Tyndall that ice, when broken up, was capable of being united again by sufficient pressure, so as to become as perfectly solid and homogeneous as it was before, it became evident that supposing a sufficient pressure to be exerted on the glacier, in the direction of its descent, to crush its substance through the contractions and gorges of its channel, and over the irregularities in its bed, it would re-form itself and solidify, and become a compact mass again as it was before, when it had passed these obstructions. This is the regelation theory.

At this stage the question had assumed this new form—"If ice be a viscous fluid, according to the viscous theory, is it fluid *enough* to descend by its own weight; or, if it be a solid, according to the *regelation* theory, is it *little* enough solid so to descend?

If, instead of ice, a glacier were of water, it *would* obviously descend by its weight. The same would be true if it were of oil, or soft mud, or quicksilver, or probably of pitch; but if it were of iron, or of copper, or of lead, it would not descend by its weight only, unless, indeed, these metals were in a state of fusion. A quicksilver glacier would descend by its weight only because it shears easily; a cast-iron one would not, because it shears with difficulty. There must, therefore, exist a relation between the shearing force and the weight of a given volume of a glacier, so that it may just descend by its weight only. Now, it is possible to investigate mathematically what that relation is.

I have made that investigation.[2] I have founded it on this well-known law of mechanical philosophy, that "the aggregate *work* of the forces which produce the displacement of a body or a system of bodies (however related) must at least equal the aggregate work of the resistances which oppose that displacement."

The resistances opposed to the displacement of a glacier are —1st. Those which oppose themselves to the shearing of one surface of ice over another, which is continually taking place throughout the whole mass by reason of the differential motion. 2ndly. The friction of the superimposed laminæ of ice upon one another, which is greater in the lower than the upper. 3rdly. Abrasion of the ice on the bottom and sides of the channel of the glacier. If it descends by its weight only, then the work of its weight in its descent through any distance must at least equal the sum of the works of all these resistances. It is of course impossible to represent this relation mathematically in respect to an actual glacier having a variable direction and an irregular channel and slope; but in respect to an imaginary one having a constant direction and a uniform channel and slope, it is possible. I have made that calculation, and it results from it that the unit of shear in ice (that is, the force necessary to make one square inch of ice shear over another square inch) must not be more than $1\frac{1}{3}$ lb. that a glacier may descend by its weight only. If the unit of shear in ice be more than that, then the glacier cannot descend by its weight only on a slope like that of the Mer de Glace. But it is a great deal more than that. It requires from 60 lb. to 120 lb. to shear one square inch of ice over another square inch. The ice of the Mer de Glace cannot therefore descend by its weight only; it does not shear easily enough. It must be ice of about the consistency of soft putty to descend by its weight only, for that substance shears with a pressure of from $1\frac{1}{2}$ lb. to 3 lb. per square inch.

Ice, therefore, if it be fluid, is not fluid *enough*, and if it be solid, it is *too* solid to descend by its weight only. There must be some other force to help it down besides its weight—certainly forty-five times greater, and possibly ninety times. The imaginary case, to which alone these calculations apply, differs indeed from the actual case of a glacier in this respect, that it is straight and uniform. But if its weight be insufficient to bring a glacier down in a straight and uniform channel, much more will it be so to bring it down a crooked and variable one. This result is directly opposed to the viscous theory and to that known as the theory of regelation, both of which attribute the descent of glaciers to their weight as the only cause. It reveals the existence of some other force. What is it?—*Lecture delivered before the Royal Institution.*

Petroleum in Locomotives.—Two engines on the Strasbourg Railway have been fitted with M. Deville's furnaces for burning petroleum, and are employed in the goods traffic. The consumption of oil in the engines drawing heavy trains is stated to have been from $3\frac{1}{4}$ to 5 kilogrammes for every kilomètre traversed, or (say) from 8 lb. to 12 lb. for every two-thirds of a mile. The oil is said to have been very completely burned, and there is no smoke, and consequently no waste.

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[2] *Phil. Mag.*, May, 1869.

REVIEWS OF BOOKS.

A Guide to the Western Alps. By JOHN BALL, F.R.S., M.R.I.A., late President of the Alpine Club. New Edition. London: Longman. 1870.

WHATEVER may be our opinion of the usefulness to the nation of a body like the Alpine Club, we can have no doubt of the utility of Mr. Ball's excellent handbook to the Western Alps. Climbers of Alpine heights, who risk their lives and endanger the happiness of friends and relatives by insane attempts to reach a mountain-peak not hitherto ascended by man, are merely wasters of human energy. If, like Tyndall, Saussure, Huxley, or Humboldt, they endeavoured to gain a particular level above the sea, with the object of adding to either physical or biological knowledge, their proceedings would not only be excusable but meritorious. But with the contemptible aim of doing a useless thing because other fellows have not troubled their heads about it, the members of the Alpine Club are little better than amateur acrobats; and, just as some of our journals would attempt, from motives of humanity, to suppress the Blondins and Léotards of the concert-hall and circus, so should we—if it were of avail—lift our voice against the foolish bearers of the alpen-stock and ice-axe.

But Mr. Ball's book is not addressed exclusively to mere climbers. It is a work of importance to all who contemplate a tour in the Western Alps, and it is as clear and comprehensive as it can be. Mr. Ball is not only a distinguished Alpine traveller, but he is also an eminent man of science; and so his *Guide* is not simply a sort of Murray or Bradshaw, but is also a scientific account of the natural and physical history of a most interesting mountain chain. Perhaps there is no account of the structure of the Alps which surpasses that of M. Desor in excellence; and it is therefore a good point in Mr. Ball's volume that the memoir of the celebrated Swiss geologist has been translated by the author, for the benefit of his readers. The remarks on Botany, Zoology, and Meteorology, and on the apparatus to be used in Alpine scientific researches, are equally good. The book is full of excellent maps, plans, and bird's-eye views, and the nature of its contents may be gathered from the following headings of the several articles it contains:—Preliminary information, passports, &c.; Routes for approaching the Alps; Plan of a tour; Modes of travelling in the Alps; Guides and porters; Inns; General advice to travellers in the Alps; Advice to pedestrians; Mountaineering; Climate and vegetation of the Alps, and Châlet life; Alpine Zoology; Meteorology and Hypsometry of the Alps—instruments used by travellers; Glaciers and Avalanches; Geology of the Alps; Books connected with the Alps and Alpine maps.

Primitive Man. By LOUIS FIGUIER. Revised Translation. London: Chapman & Hall. 1870.

IT will be remembered that when we some months since noticed the French edition of this work, we stated that Messrs. Chapman & Hall intended to publish an English translation of it. This promise on the part of the eminent firm in Piccadilly has now been fulfilled, and a very handsome, profusely illustrated and well printed volume is now before us. Of the merits and demerits of the work itself we need not now speak, having already dealt with them in our former critique. The illustrations, which are scattered through the text are of an excellent character, and are numerous and instructive; the plates, on the other hand, are in the worst style of the cheap pictorial Bible. The translator has kept very closely—perhaps a little too closely—to the original; but still the style is not defaced by many Gallic idioms, though it is essentially French in the interrupted and somewhat spasmodic character of some of the sentences.

A System of Botanical Analysis applied to the Diagnosis of British Natural Orders, for the Use of Beginners. By W. HANDSEL GRIFFITHS, Ph.D. London: Wyman & Sons, 1870.

OF the many wants which botanical students experience in this country, a systematic method of analysis for the reference of plants to their natural orders is most certainly not one. We cannot, therefore, understand that there is any *raison d'être* for the present work, beyond the statement in the preface, that it is "published at the request of the author's pupils." This is not the first work which has seen the world owing to a similar cause; and all we can say about the matter is, that "authors' pupils" and "authors' friends" have a great deal to answer for.

We must distinctly protest against artificial systems of analysis. No doubt they are sometimes almost unavoidable; but, used in the wholesale way in which Dr. Griffiths would seem to employ them in the case of his pupils, they tend to generate the most pernicious empirical ideas of plant affinities, and, furthermore, are nearly absolutely unnecessary. In the *brochure* before us we find a host of tabular schemes for the identification of the natural orders of plants, which are not very simple for the student, and which have the great objection that they bring together plants which have no more relation to each other in structure than a mouse has to a mastodon; and this difficulty the author having created, imagines he gets over by printing these objectionable orders (which mar his plan) in italics. As an example of this method, so hurtful to the young mind seeking to appreciate natural grouping among plants, we may cite the following instances:—The *Ericaceæ* come beside the *Oxalidaceæ;* the *Santalaceæ, Saxifragaceæ, Onagraceæ,* and *Aristolochiaceæ,* fall into one group; and lastly, the *Ulmaceæ* and *Lythraceæ* get together. The *cacoëthes scribendi* ought to be more restrained by teachers than it is. Dr. Griffiths says he has read Bentham's works; if so, let him turn to the *Handbook of the British Flora,* and ask himself whether he thinks his schema an improvement on the beautifully natural and philosophical "Analytical Key" and "Arrangement of the Natural Orders" which that work contains?

The Origin and History of Irish Names of Places. By P. W. JOYCE, M.A., M.R.I.A. Second Edition. Dublin: M'Glashan & Gill. 1870.

THE appearance of a second edition of this work shows us that the treatise has found an appreciative and goodly number of readers, at least in Ireland. It is a contribution to philology which cannot fail to be useful to students of Keltic, and which is really a very interesting book to read. It is to be regretted that the author did not carry his philological inquiries a little further than he has done. For instance, there can, we think, be little doubt that there is some connection between Keltic and ancient Punic tongues; and it would have been instructive to have learnt whether this supposed connection is borne out in the names of localities. Certain monumental inscriptions in Ireland have been said to resemble Phœnician characters; and it is stated that in one of Plautus' plays ("Pœnulus," we think) certain Punic sentences are introduced, whose affinity to Keltic is (at all events, superficially) very strongly indicated. But for all this, Mr. Joyce's book is one displaying considerable erudition, and it is one which every Irishman loving his country (and where is the Irishman who does not?) should purchase and study.

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CORRESPONDENCE.

It is distinctly to be borne in mind that we do not, by inserting letters, convey any opinion favourable to their contents. We open our columns to all, without leaning to any; and thus supply a channel for the publication of opinions of all shades.

No notice whatever will be taken of anonymous communications.

We cannot undertake to return rejected communications.

UNDERGROUND TEMPERATURE.

SIR,—I send you monthly the variations of a thermometer 2 ft. in the ground, which you are kind enough to place in your columns.

I have suggested the fluctuations + and — of these temperatures may be caused by the internal gas of our earth, which causes earthquakes.

We learn there was a violent volcanic eruption in Japan on 22nd May last. On that day, in some localities, the thermometer fell, about 5 p.m., 22°. On the 23rd, in many places, a peculiar tint was seen in the air; the sun, in the morning, of a *deep orange*, in the evening, at setting, of a very *unusual purplish pink* hue. This was noticed from Tynemouth at 5 p.m. on the 22nd, at Cambridge at 10 a.m. on the 23rd, and in Gloucestershire both days, the sky being hazy at the time. The same appearance was seen at Dublin on the 22nd in the afternoon—perhaps at other places also.

Could this have been caused by the exudation of that internal gas which causes our earthquakes, as an escape of steam affects a steam engine, and sometimes ends in an explosion or a volcanic eruption?

Yours obediently,

Havant, June 20. C. J. B.

SCIENTIFIC SOCIETIES

Secretaries of Societies will oblige us by regularly forwarding "Abstracts of Proceedings;" and they would do much to enhance the interest and success of their meetings if they would enable us to publish in anticipation "notices of papers to be read."

GEOLOGICAL SOCIETY.

JUNE 8TH.—Joseph Prestwich, Esq., F.R.S., president, in the chair.

Henry G. Vennor, Esq., of the Geological Survey of Canada, Montreal; Alexander Kendall Mackinnon, Esq., M. Inst. C.E., Director-General of Public Works, Montevideo, South America, and Arthur Roope Hunt, Esq., Quintella, Torquay, were elected Fellows of the Society.

1. "On the Superficial Deposits of the South of Hampshire and the Isle of Wight." By Thomas Codrington, Esq., F.G.S.

This paper treated of the gravel deposits covering the tertiary strata of the country between Portsmouth and Poole, and of the Isle of Wight.

The strikingly tabular character of the surface is best seen on the east of the Avon, where from the coast for more than twenty miles inland a gravel-covered plain can be followed, rising gradually from 80 ft. to 420 ft. above the sea, at the rate of about 20 ft. per mile. The high plains of the New Forest, to the eye perfectly level, and indented by deep valleys, are portions of this table-land. The plateau between the Bournemouth Cliffs and the Valley of the Stour, and detached gravel-capped hills further inland, are the remnants of a similar table-land on the west of the Avon, while eastwards the same character prevails up to Southampton Water. Sections parallel with the coast show the level nature of the country, broken only by well-defined river-valleys. On the east of Southampton Water a similar tabular surface, sloping at a steeper angle towards the shore-line, and cut through by the valleys of the Itchen, Hamble, and Titchfield rivers remains; and in the Isle of Wight the gravels capping the flat-topped tertiary hills coincide with a corresponding plain sloping northwards.

The gravel covering these table-lands is composed chiefly of sub-angular chalk-flints, with a varying proportion of tertiary pebbles. Sarsen stone blocks are found everywhere, and on Poole Heath granitic pebbles; and in the gravel of Portsea large boulders of granitic and palæozoic rocks are met with. In the Isle of Wight, chert from the Upper Greensand; and materials from the Lower Cretaceous beds also occur. The colour of the gravel is generally red; and the origin of the white gravel, which often overlies the red, is to be ascribed to the bleaching action of vegetable matter. Brick-earth is generally associated with the gravel at all levels but the highest; but the contorted appearances attributed to glacial action only occur at low levels.

No organic remains have been found in the gravel covering the plains, while the valley-gravels of the district have afforded mammalian bones and teeth of the usual species. Flint implements have been found at Bournemouth at 120 ft. above the sea; at Lymington, near Southampton, at 80 and 150 ft.; and also along the shore between Southampton Water and Gosport, at 35 ft. above the sea, from gravel forming part of the covering of the tabular surface, and unconnected with the river valleys.

The gravel capping the cliffs of the south coast of the Isle of Wight, in which the remains of *Elephas primigenius* have been found near Brook and Grange, was probably deposited in the same river-basin as the mammaliferous gravel of Freshwater; and the cutting back of the coast-line by the sea has given the tributaries of a river which flowed by Freshwater northwards to the Solent, a direct outfall to the sea; and the streams thus intercepted at a high level, under the changed condition of flow, have originated the *Chines*.

The gravel cliff of the Foreland, at the eastern end of the Isle of Wight, consists principally of raised shingle, which towards the south thins out, and is overlain by a thick deposit of brick-earth, a continuation of which caps the cliffs up to the chalk, and in which a flint implement was found by the author at 85 ft. above the sea.

General Considerations.—The marine gravel, with granite boulders covering the south of Sussex, is continued westward by the gravel, with similar boulders covering Portsea Island; and this again by the Hill-head gravels, with large blocks of Sarsen stone, these lower gravels being bordered on the south by the raised shingle deposits of the Isle of Wight, and on the north by the higher marine gravels of Avisford, Waterbeach, and Bourne, from which the lower gravel is divided by a well-marked stop, extending beyond Portsdown Hill to Titchfield, and traceable on the west of Southampton Water. The Hill-head gravels are considered to be an estuarine deposit, of the same age as the marine gravels of Sussex, and the low level gravels of the river-valleys; they are supposed to have been formed when the Isle of Wight was still joined to the mainland, and all the rivers now reaching the sea by Poole Harbour, Christchurch Harbour, Southampton Water, &c., were affluents of a river communicating with an estuary opening to the sea in the direction of Spithead.

The gravels lying above the step, such as those of Avisford and Waterbeach, Titchfield Common, Beaulieu Heath, and Bournemouth, are looked upon as equivalent in position and age to the high-level valley gravels.

The level of the gravels on the highest parts of the table-lands is such as to indicate an age far greater than that of the highest gravels of the river-valleys; but the uniform surface from the 400-ft. level downwards points to a long continuance of similar conditions, during which the gravel from the highest levels to that of the Bournemouth cliffs was deposited. The area that can with any probability be assigned to the catchment basin of a river such as that which has been before alluded to, is only three-quarters of the basin of the Thames above Hampton, within which it is difficult to imagine that such an extent of gravel could have been spread out; and the inclination of the flattest of the table-lands is for a river such as only mountain streams have, and quite incompatible with the spreading out of large even surfaces more than twenty miles across.

It is considered more probable that the materials of the gravel were brought down from the chalk country on all sides by rivers, and spread out in an inlet of the sea shut in on the south, and opening out eastwards. This view is not without difficulties; it involves a gradual upheaval of the land, which, when the highest gravels now remaining were being spread out at or near the sea-level, must have stood more than 400 ft. lower; and a considerable part of this upheaval must have taken place since the formation of the gravel in which implements fashioned by man are imbedded.

Discussion.—The President referred to the raised beach at Brighton, which he had traced thence as far as Chichester. He inquired what evidence there was of the marine origin and contemporaneity of the the beds identified with this beach by Mr. Codrington.

Mr. Whitaker noticed the occurrence of gravels similar to those described by Mr. Codrington on the slope between Canterbury and Herne Bay as indicative of the presence of a large river. He agreed with the author in considering that the white gravel was produced by the decolorization of the red; and remarked that it was unusual to find angular gravels of thoroughly marine type.

Mr. C. Moore remarked that the gravels and brick-earths from Salisbury westward are all of freshwater origin, and contain the remains of frogs in great abundance, together with freshwater shells, bones of Arvicolæ, &c.

Sir Charles Lyall was inclined to ascribe the formation of the gravels described to the sudden melting of snow in great quantities. He referred to the presence of Sarsen stones as indicating that there was force enough to carry large masses.

Professor Ramsay referred to the great denudation of Eocene strata which must have taken place before the present form of the land was produced, as implying an immense amount of river-action, the immediate results of which are now masked by the modifications produced by subsequent subaërial changes of more limited extent. He maintained that the finding of flint implements at various elevations furnished no evidence of change in the relative level of sea and land.

Mr. Codrington, in reply, stated that the gravels were not valley gravels such as those mentioned by Mr. Moore. He did not see how glacial action could have spread the gravels over flat table-lands.

2. "On the relative position of the Forest-bed and the Chillesford Clay in Norfolk and Suffolk, and on the real position of the Forest-bed." By the Rev. John Gunn, M.A., F.G.S.

The author commenced by stating that both at Easton Bavent and at Kessingland the Forest-bed is to be seen forming part of the beach, or of the foot of the cliff, and underlying the Chillesford Clay. He considered that the soil of the Forest-bed had been deposited in an estuary, and that after its elevation the trees, of which the stools are now visible along the coast, grew upon it, and the true Forest-bed was formed. After the submergence of this, first freshwater, then fluvio-marine, and finally marine deposits were formed upon it; and the author propsed to give the whole of these deposits the name of the "Forest-bed series." The author suggested that the Forest-bed itself is represented inland by the stony bed which lies immediately upon the chalk and between it and the Fluvio-marine and Marine Crags, his theory being that the surface of the Chalk, after supporting a Forest-bed Fauna, was gradually covered up by successive Crag deposits.

Discussion.—Sir Charles Lyell considered the Forest-bed to be older than the Stony-bed.

Mr. Gunn remarked that at Easton Bavent the Chillesford Clay is in the cliff, and the Forest-bed in the beach beneath it. He referred to various instances of the occurrence of mammalian remains on the coast.

3. "On a new Labyrinthodont Amphibian, from the Magnesian Limestone of Midderidge, Durham." By Albany Hancock, Esq., F.L.S., and Richard Howse, Esq. Communicated by Professor Huxley, F.R.S., F.G.S.

The specimen described by the author was remarkable for the great development of the ventral scutes, which were of large size, minutely striated, imbricated, and arranged in diagonal lines, sloping from behind forward, giving the surface of the fossil a strongly ribbed appearance. The authors stated that it was allied to Dasyceps and to *Pholiderpeton scutigerum* (Huxl.); but from the peculiar characters of its scutes, its elongated narrow muzzle, and some other peculiarities presented by the head, they regarded it as forming the type of a new genus, which they proposed to name Lepidotosaurus. The species they named *L. Duffii*, in honour of its discoverer, Mr. Joseph Duff.

4. "On *Proterosaurus Speneri*, von Meyer, and a new species, *Protenosaurus Huxleyi*, from the Marl-slate of Midderidge, Durham." By Albany Hancock, Esq., F.L.S., and Richard Howse, Esq. Communicated by Professor Huxley, F.R.S., F.G.S.

In this paper the authors described a specimen which they referred to *Proterosaurus Speneri*, von Meyer; and one of a smaller form, which they regarded as new, and described as *Proterosaurus Huxleyi*. Both were from the same part of the Marl-slate of Midderidge, Durham. The two species agree in having the limbs and tail long, and the neck long, and composed of seven vertebræ, in the number of dorsal vertebræ, in the number and character of the bones of the hand, and in some other particulars, sufficient, with these, in the opinion of the authors, to justify the reference of both to the genus Proterosaurus. In *P. Huxleyi* the ribs are flattened instead of rounded at the proximal extremity, and less widened and grooved at the distal extremity than in *P. Speneri*; the hind limb is considerably longer in proportion to the fore limb; and the distal extremity of the humerus is only twice as wide as the constricted part, instead of three times, as in the old species.

The following specimens were exhibited to the meeting:—

Specimens of Labyrinthodonts, &c., from the Upper Carboniferous of Lanarkshire; exhibited by James Thomson, Esq., F.G.S.

Specimens from the Lower Silurians of Roxburghshire; exhibited by Professor Elliot.

Flint Implements from Hampshire and the Isle of Wight; exhibited by Thomas Codrington, Esq., Esq., F.G.S.

Wings of Insects from the Devonian of New Brunswick; exhibited by Principal Dawson, F.R.S., F.G.S.

Gold in Quartz, from the Thames District, New Zealand; exhibited by Professor Tennant, F.G.S.

Skull of a Labyrinthodont from the Coal-measures of Shropshire: exhibited by G. Maw, Esq., F.G.S.

Jaw of *Baphetes minor*, Dawson, from the Coal-measures of Nova Scotia; exhibited by Principal Dawson, F.R.S., F.G.S.

ZOOLOGICAL SOCIETY.

JUNE 9TH.—George Busk, Esq., V.P., in the chair. The Secretary read some notices of the principal additions to the Society's menagerie during the month of May, and called particular attention to a deer, sent home from Singapore by order of H.R.H. the Duke of Edinburgh. This animal appeared to belong to a new species, and was proposed to be called *Cervus Alfredi*.

Professor Newton, V.P., exhibited a series of skins of the large falcon found in Alaska, and sent to this country for examination by the Smithsonian Institution, and referred them to the *Falco islandicus* of Gmelin.

Mr. Gould exhibited and made remarks upon some skins of *British* Water-ouzels.

Mr. R. Swinhoe read a series of zoological notes made during a journey from Canton to Pekin and Kalgan. Mr. Swinhoe's remarks contained descriptions of several new species of mammals and birds, amongst which were a new hedge-hog, proposed to be called *Erinaceus dealbatus*, and a new species of dwarf swan, for which the name *Cygnus Davidis*, after M. le Père David, its discoverer, was proposed.

Mr. R. Swinhoe also read a paper containing Notes on certain Reptiles and Batrachians collected in various parts of China.

Mr. R. B. Sharpe read a paper on "The Ornithology of Madagascar, based upon a collection recently formed by Mr. A. Crossley in the neighbourhood of Noce Vola, in the north-western portion of the island. Two new species were discriminated, and proposed to be called *Ceblepyris major* and *Corethrura insularis*. Two species—namely, *Bernieria Crossleyi*, of Grandidier, and *Ellisia Madagascariensis*, of Hartlaub—were likewise generically separated, under the respective names of Mystacornis and Oxylabes.

Dr. John Hawkes, F.Z.S., communicated a note on a case of *hernia ventriculi* in a common canary.

Mr. D. G. Elliot exhibited and pointed out the characters of two new species of pheasants, from the province of Yarkand, proposed to be called *Phasianus Shawii* and *P. insignis*; also a well-marked permanent variety of *P. torquatus*, from the island of Formosa, proposed to be called *P. Formosanus*. Mr. Elliot also made remarks on the

affinities of the known species of true Phasianus, and pointed out their geographical distribution.

A communication was read from Mr. A Sanders, F.Z.S., containing notes on the miology of a Geckoid lizard, *Platydactylus japonicus*.

A communication was read from Mr. Gerard Krefft, C.M.Z.S., of Sydney, containing a preliminary account of the skeleton of a rare whale, probably identical with *Dioplodon Sechellensis*, recently obtained in the Australian seas, near Lord Howe's Island.

Messrs. Sclater and Salvin communicated a synopsis of the birds of the family of Cracidæ. The authors proposed to divide this family into three sub-families—the Cracinæ, Penelopinæ, and Oreophasidinæ. Of the first of these, twelve species were recognised; and of the second thirty-eight; while the third contained only one representative. One species of Guan was described as new, and proposed to be called *Ortalida erythroptera*.

A communication was read from Professor Barboza du Bocage, F.M.Z.S., containing a description of the young of *Pelecanus Sharpii*.

Dr. A. Günther communicated an account of the species of tailless Batrachians, recently added to the collection of the British Museum, amongst which was a new diminutive frog, recently discovered by Dr. Cunningham, in Fuegia, and proposed to be called *Nannophryne variegata*.

Dr. J. Murie read a paper on "The Anatomy and Osteology of the Saiga" (*Saiga tartarica*), founded on examples of this mammal that had lived in the Society's gardens. The conclusions arrived at by the author as to the systematic position of the Saiga were, that this animal cannot be well included in any of the subdivisions of the Ruminants hitherto established, but constitutes a form intermediate between the sheep and the antelope.

ANTHROPOLOGICAL SOCIETY OF LONDON.

June 14th.—John Beddoe, Esq., M.D., president, in the chair.—Logan D. H. Russell, Esq., M.D., of Wilmington, Delaware, was elected a local secretary.

A Paper, by Dr. Henry Hudson, was read "On the Irish Celt," in which the author depicted the mental and moral characteristics of that type, and drew conclusions as to the kind of government most suitable to such a people.

Mr. G. H. Kinahan contributed a paper "On the Race Elements of the Irish People." That paper entered largely into the pedigree of the chief families of Connaught and Munster, and treated of the effects of the Cromwellian and other confiscations.

The President (Dr. Beddoe) then read a paper "On the Kelts of Ireland." The principal points proved or indicated in it were the following:—That the Kelts known to the Greek and Latin authors, though they were a light-haired race as compared with the Italians, were darker than the Teutonic tribes; and that their physical type differed in other respects. That the Irish are, generally speaking, a dark-haired but light-eyed race, and that wherever there is much light hair it may be accounted for by a Danish or English cross. That the dark hair of the Irish may be, partly at least, attributed to the Gaelic Celts. That there is less resemblance between the Irish, taken as a whole, and the Basques, who are generally considered to be the purest Iberians extant, than between the South Welsh and the Basques. That any Basque or Iberian element in Ireland is probably small, and can have only partially contributed to the prevalence of dark hair among the Western Irish. That Ugrian or Ligurian elements may also be present there.

The paper was illustrated by minute details respecting the physical types in various parts of modern Ireland, including extensive observations on the colour of the eyes and hair; and the author exhibited a number of photographic and other portraits of Basques and of Bretons, Welshmen, Walloons, and other supposed descendants of the Keltic race.

In the discussion which ensued the following gentlemen took part:—Rev. Dunbar I. Heath; Professor Henry, of the Smithsonian Institute, Washington; Mr. Walter Dendy, Dr. C. P. C. Blake, Mr. J. E. O'Cavanagh, Dr. Charnock, Mr. Edward J. Wade, Dr. Seemann, and the Chairman.

The Chairman then adjourned the meeting till next session, Nov. 1.

METEOROLOGICAL SOCIETY.

June 15.—Ordinary meeting. Charles V. Walker, F.R.S., president, in the chair. William C. Ellis, and Francis Nunes, M.A., were elected Fellows; and Padre Professor F. Denza was elected an Honorary Fellow of the Society.

The following papers were read:—

On "The Path of the large Fireball of November 6th, 1869," by Professor A. S. Herschel.

On "Air Temperature in Natal, South Africa," by R. J. Mann, M.D., F.R.A.S., &c.

On "The Atmospheric Pressure in Relation to Wind and Rain," by R. Strachan, F.M.S.

On "The November Meteors of 1869, as seen from the Mauritius," by Charles Meldrum, M.A., F.R.A.S.

The anniversary meeting was then held, and the report of the Council on the present state of Meteorological Science, both at home and abroad; also their report on the present state of the Society—which now numbers 348 Ordinary, Life, and Honorary Fellows—and the treasurer's report were then read and adopted.

The following list of names, which was drawn up and proposed by the retiring Council, was then ballotted for, and announced as the Officers and Council for the ensuing year:—President—C. V. Walker, F.R.S., F.R.A.S. Vice-presidents, N. Beardmore, C.E., F.R.A.S; F.R.G.S., F.G.S.; C. O. F. Cator, M.A.; Robert J. Mann, M.D., F.R.A.S., F.R.G.S.; and John U. Tripe, M.D. Treasurer—Henry Perigal, F.R.A.S., F.R.M.S. Trustees—Antonio Brady, F.G.S., F.R.M.S.; and S. W. Silver. Secretaries—Charles Brooke, M.A., F.R.S., F.R.C.S., &c.; and James Glaisher, F.R.S., F.R.A.S., &c. Foreign Secretary—Lieut.-Col. A. Strange, F.R.S., F.R.A.S., &c. Council—A. Brewin, F.R.A.S.; G. Dines; F. W. Doggett; H. S. Eaton, M.A.; F. Gaster; C. M. Gibson; Rev. J. B. Reade, M.A., F.R.S., &c.; W. Wilson Saunders, F.R.S., F.L.S., &c.; Thomas Sopwith, M.A., F.R.S., &c.; Geo. J. Symons; S. C. Whitbread, F.R.S., F.R.AS.; and E. O. W. Whitehouse, F.S.A., &c.

RECENT LECTURES AT THE ROYAL INSTITUTION.

On Saturday, June 11th, Professor Robert Grant, of Glasgow, delivered his closing lecture, on "The Astronomy of Comets." The audience had become gradually familiarized with the history and appearance of these remarkable bodies. In his previous discourses the lecturer had pointed out how Aristotle had described them to be generated in the upper regions of the atmosphere; how aerolites, meteors, and comets were looked upon much as one and the same kind of masses; and how modern times had shed more and more light on the matter. Tycho Brahé, the Danish astronomer, first opened the way for further investigation by showing that the comet of 1577 revolved beyond the moon's orbit; thus establishing the fact that comets have to be considered as celestial bodies.

The imperfections of the implements employed by Newton did not enable that great philosopher to precisely ascertain the shape of the comets' orbits, which he believed to revolve in ellipses, while he could only demonstrate them to move in parabolæ, having the sun in the focus. By means of diagrams, the lecturer explained how any one of the three curves known as the conic sections may be described by a comet under the influence of the sun's attraction.

Halley's enormous labours with regard to the discovery of the periodicity of the comet which bears his name, and the general theory established by him were dwelt upon, as were also the accounts given by the Chinese in their annals. The latter have proved valuable additions to our own store of knowledge on the subject.

The perihelion passage of some comets, the intense heat to which the one of 1843, for instance, was exposed, and the disturbance often caused at such periods, were shown to have produced phenomena of the most peculiar and striking nature. Biela's comet, its separation and its reappearance in that State in 1852, are facts still in the memories of many living, as are also the magnificent sights displayed by Donati's in 1858, and the singular structure of the great comet of 1861. The lecturer exhibited some diagrams, which appeared to give a good idea of the formation of tails, from the hoods which at times issue from the heads of comets.

Meteors were described as belonging to one of these three classes:—1. Aerolites; 2. Fire Balls; and 3. Shooting Stars. Many instances from antiquity and from modern times were cited, showing the repeated falls of stones, sometimes by thousands, on various spots of the globe. Metallic masses in places where their appearance is totally unjustified by the neighbouring formation must also be looked upon as having descended from above. The number of shooting stars, as visible all over the earth, is something astounding. They are proved to be cosmical bodies, on account of their having a greater velocity than the earth. The periodicity of meteor showers, certainly one of the most remarkable discoveries in modern astronomy, was established by the researches of Professor Adams. Professor Newton, of Yale College, United States, was also creditably mentioned by the lecturer. The agreement existing between the orbit of the meteoric stream and the orbit of the first comet of 1866, was clearly shown by the figures connected with these researches. Professor Grant hoped that the future would disclose more relating to the physical conditions of comets, of which, at the present day, little could be said.

The course of these lectures by the Glasgow professor was one of the best delivered at the Royal Institution during this session. There

was, indeed, less experimental display than other subjects allow, but the discourses were highly interesting and instructive, and delivered in a manner becoming a true and genial philosopher.

RICHMOND AND NORTH RIDING NATURALISTS' FIELD CLUB.

The monthly meeting was held in the museum on Tuesday last. The president (Mr. Wood, F.G.S.) occupied the chair, and exhibited a large and instructive series of deep-sea dredgings from many parts of the world, sent to him by Mr. Wake, of Sunderland, including specimens of a Terebratula, a crab, and many corals, from the dredging of the Porcupine in mid-Atlantic. Much interest was caused by the statement that some of these organisms had been dredged from a depth of nearly three miles. The president vigorously described a lecture he had listened to, with great instruction, in Dublin, by Professor Wyville Thomson, proving how thoroughly our most eminent geologists have been mistaken as to the existence of life in the profound depths of the ocean.—A well-stuffed specimen of the now almost extinct old black rat (*Mus Rattus*), from Stockton-on-Tees, kindly forwarded for exhibition by Mr. E. R. M. Middleton, jun., of West Hartlepool.—Mr. E. Pilkington liberally sent for exhibition a beautifully illuminated Roman missal, date about 1480. Fine specimens of Indian corn and cotton plants were sent for exhibition by Mrs. Skelton.—Mr. J. W. Bradley, of the Grammar School, exhibited dresses and implements used by the Fiji Islanders, and gave a long and interesting sketch of their curious customs and dresses. The whole of the series was placed at the disposal of the president and the club.—Mr. Ingoldby presented a Japanese sun-shade, and bows and arrows, of exquisite workmanship. —The following paper on "Discoveries of Lepidoptera" was read by Mr. C. A. Harris:—"It will, I hope, please all who take an interest in the exaltation of our club to hear that this year we have discovered the Larva Pupa and Imago of a species hitherto unknown in England. The moth is a Geometer, and from its characteristics it can be assigned to the genus Amphydasis. One of the larva which I exhibited last year proved to be the larva of *Ennomos Tiliaria*, hitherto unreported as English. We also took other larva, which were unreported, in the north of England, and we hope to bring Richmond forward on the lists of new Lepidopterous localities." The president alluded to the proposed excursion to Flamborough Head. After election of members, the meeting closed with votes of thanks to Mr. Bradley for his graphic description, and to the donors and the president.

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

June 9th.—Mr. Sewell, vice-president, in the chair.

The receipt of Scientific Opinion from the editor was announced.

Mr. Wonfor, hon. sec., reported on the very successful visit paid by the Society on the previous Saturday to Finden, when they were very hospitably entertained by Mr. H. Willett. It was resolved that, in place of a field excursion on the 9th of July, a "marine one" be organized.

A paper on "Diptera and their Wings," by Mr. Peake, in the unavoidable absence of that gentleman, was read by the hon. sec. While wings are common to the whole order of insects, the Diptera consist entirely of two-winged flies; but, instead of a second or hinder pair, they have little thread-like bodies terminated by knobs, which are called *Halteres*, originally considered balancers, supposed now by some to be *olfactory* organs, and by others organs of *hearing*. From many points of resemblance, he thought they were analogous to the hind wings of insects, and that at present their special use had not been ascertained. Besides the Halteres, they had also winglets, *alulæ*, which were thought to be only appendages to the fore-wings. Among the Diptera three classes of fliers were found, differing in the form of their bodies and shape of their wings; first, the slender flies, such as gnats, having long bodies, narrow wings, and long legs, but without winglets; secondly, those whose bodies, though slender, are more weighty, as the Asilidæ, having larger wings, shorter legs, and very minute winglets; lastly, those like the house-fly, with short, black, and often very heavy bodies, furnished with proportionate wings, shorter legs, and conspicuous winglets. From these circumstances it might be inferred that the long legs of the light-bodied flies acted as rudders, while the winglets of the larger and heavier-bodied flies assisted the wings in flying. The wings might be described as transparent membranous organs, consisting of two laminæ, united by veins or nerves; and upon their arrangement, and the form of the antennæ, the distinguishing characters of the Diptera are founded.

The several parts of the wings and nervures, and their differences, as seen in the great groups *Nemocera* and *Brachycera*, were next pointed out; and the paper illustrated by very beautiful drawings, made by Mr. Peake with the camera lucida, and by microscopical preparations of wings, &c.

EDINBURGH BOTANICAL SOCIETY.

The Society met on Thursday, 12th May, in the Class-room, at the Royal Botanic Garden—Sir Walter Elliot, President, in the chair.

Professor Balfour noticed the death of Sir J. Y. Simpson, Bart., who joined the Society in April, 1852, and who ever since had continued to take an interest in their proceedings, and he suggested that the Society should record their sense of the loss they had sustained, and that a letter of condolence be sent to Lady Simpson and family, which was unanimously agreed to.

Donations to the Museum, Herbarium, and Library were announced.

The following communications were read:—

1. "Botanical Notes of a Journey through Spain and Portugal," by T. C. Archer, Esq. 2. "Botanical Notes on the Garden of Monserrat, Portugal," by T. C. Archer, Esq. 3. "Botanical Notes taken on the Rock of Gibraltar," by T. C. Archer, Esq. 4. "Report on the Open-air Vegetation at the Royal Botanic Garden," by R. M'Nab.

At the last meeting of the Botanical Society (14th April) I gave a long list of the open air plants then in bloom. The April meeting generally exhausts all the plants usually quoted, but the extreme backwardness of the season has left a few of them still unnoticed. These I now supplement. The temperature during the past month has never been very low; but vegetation is still very much behind, caused in a great measure by the dry state of the weather which we have recently experienced. The six lowest morning temperatures during the past month were on the 18th, 20th, and 27th April; and 2nd, 4th, and 7th May, when the thermometer indicated respectively 31, 35, 35, 34, 30, and 33 degrees; while the six highest early morning temperatures were on the 16th, 21st, 24th, and 25th April; and on the 6th and 10th of May, when the markings were respectively 43, 45, 44, 47, 45, and 47 degrees.

The following table exhausts the usual list of spring flowering plants, with the dates of their flowering last year:—

	Date of Flowering, 1870.	Date of Flowering, 1869.
Fritillaria imperialis	April 15	March 24
Narcissus bicolor	„ 16	„ 29
Anemone nemorosa	„ 17	April 3
Saxifraga virginica	„ 19	„ 2
Menziesia empetriformis	„ 20	„ 1
Ornithogalum excapum	„ 20	March 30
Primula ciliata purpurata	„ 20	April 3
Epimedium rubrum	„ 21	„ 2
Ornithogalum montanum	„ 28	„ 2

V. Miscellaneous Communications.

1. Shetland Algæ.—Mr. Peach gave a list of forty-one species of Algæ, collected by Miss Jeffreys in 1864, at the Outer Skerries of Whalsey, ten of which are additions to Edmonston's list.

2. *Saxifraga cernua*.—Mr. Christie exhibited growing flowering plants of what appeared to be *Saxifraga granulata*, which, he stated, had been obtained from the bulblets of plants of *S. cernua*, collected on Ben Lawers.

Professor Balfour remarked, that although it was believed by some that *S. cernua* was only an Alpine form of *S. granulata*, yet he doubted Mr. Christie's conclusion, as plants of *S. cernua* from Ben Lawers had been cultivated in the Botanic Garden for many years, and never changed their normal form. Mr. Sadler thought that, as *S. granulata* also occurred on Ben Lawers near the place where *Saxifraga cernua* grew, it was possible that the two species had been collected by Mr. Christie, and got mixed before planting them in pots. Mr. White stated, that as far as his knowledge of species went, he firmly believed that it would be yet fully proved that *S. cernua* was only a form of *S. granulata*.

3. *Salvinia natans*.—Professor Balfour exhibited growing plants of *Salvinia natans*, which had recently been sent to the Botanic Garden from Hamburg, and described its different stages of development and mode of reproduction.

4. *Tupa rhynchopetala*.—Mr. Sadler exhibited dried specimens of *Tupa rhynchopetala*, a Lobeliaceous plant from Abyssinia, and called attention to the peculiar structure of its stem, in having a zone of woody cylinders arranged in a network through the cellular bark.

5. Mr. A. Craig Christie exhibited and presented to the Museum a series of models, prepared by himself, illustrating the embryos and fruit of Cruciferæ, fruit of Umbelliferæ, flower of fuchsia, and an ideal plant.

6. Miss Gibson-Craig presented a specimen of *Sphæria Robertsii*, the catepillar fungus, from New Zealand.

7. Mr. R. T. Mackintosh exhibited a portion of the trunk of an ash from Moffat, with a remarkable development of "knots."

8. Mr. Evans, Bank House, Penicuik, presented fertile specimens of *Equisetum umbrosum*, collected on a bank near his house, in April last.

9. Mr. M'Nab placed on the table a large collection of Alpine plants in flower.

10. Professor Balfour exhibited, under microscopes, some recently discovered species of diatoms—contributed by M. Eulenstein, of Dresden.

NOVA SCOTIAN INSTITUTE OF NATURAL SCIENCE.

Ordinary Meeting, May 9th, J. B. Gilpin, M.D., vice-president, in the chair.—Mr. Frederick Allison read a paper entitled "Meteorological Observations at Halifax, N.S., for the year 1869," which gave the following results for each month:—January had a mean temperature of 23° 29′, the maximum being 54° 3′ and the minimum 6° 8′. Mean barometric reading, 30·994. Rain, inches, 3·04. Prevailing wind, N.W., with a mean force of 2·1. February had a very equable temperature: mean, 26° 13′; minimum, 6° 3′; maximum, 44° 2′. Mean of barometer, 29·828; maximum, 30·394. Rain, inches, 3·2. Prevailing wind, N.W. During March the maximum temperature was rather high, and the minimum very low, giving a very wide range. The 11th was the warmest day—mean, 41° 17′; and the 9th the coldest—mean, 8°. The barometer's range, 1·360, was much as usual. Hygrometrical observations gave no unusual results. Greatest elastic force was on the 10th, and the least on the 6th. North-west winds again prevailed. Peach-trees blossomed on the 24th, and wild geese (*Anser Canadensis*) passed over Halifax on the 26th. In April both the maximum and minimum thermometric readings were high—the former being 68° 7′, and the latter 38° 72′. Barometer—maximum, 30·113; minimum, 29·317. Rain, 2·21 in. Prevailing wind, S.E. A very extensive range of temperature characterized May, being almost identical with that of May, 1868; the former being 55° 6′, and the latter 55° 5′. The maximum temperature was 77° 7′, and the minimum 22° 1′. Mean barometric reading, 29·601. Prevailing wind, S.E. Daffodils and violets blossomed on the 10th. The humming-bird (*Trochilus colubris*) was first seen on the 14th, and rhubarb was fit to cut on the 18th. June was remarkable for a very high barometer—the maximum being 30·070; the minimum, 29·401; and the mean, 29·834. The maximum temperature occurred on the 27th, being 80° 7′; and the minimum on the 10th, 38° 6′. South-east winds still prevailed, though but slightly over south-west, the usual summer wind. The narcissus blossomed on the 4th, the crab and apple on the 11th, and the horse-chesnut on the 12th. On the 16th wild strawberries were found in the country in abundance, and on the last day of the month garden strawberries were picked. July was noted for its extremely bright and clear atmosphere. The range of temperature was small, the maximum being low, and the minimum rather higher than usual—the former being 80° 8′, and the latter, 46° 9′. Maximum of barometer, 30·163; minimum, 29·246. Prevailing wind, S.W. Rain, 2·92 in. New potatoes were for sale in Halifax market on the 7th, and peas on the 15th. Cherries were ripe on the 22nd, and raspberries on the 28th. August was a very fine month, though cool—the mean temperature being remarkably low, 59° 62′, and the maximum only reaching 79° 9′. The barometer generally stood high, 30·231 being the maximum. Rain, 2·58 in. Prevailing wind, N.W. Red currants and cucumbers ripened on the 3rd; the first dahlia blossomed on the 5th, and the holly-hock on the 9th. September had little cloud and was very dry, rain falling on eight days only, 1·57 in. being registered. The range of temperature was not great—the maximum being 78° 9′, and the minimum 35° 1′. Hoar frost was deposited on the morning of the 22nd, being the first since May 11th, a period of 134 days. Barometric maximum, 30·304; minimum, 29·508. Prevailing wind, S.W. Peaches were ripe on the 17th. In October the amount of precipitation was nearly fifty per cent. above the average, and the total amount of rain and melted snow was 7·30 in. In temperature a very high maximum was marked on the 4th, 74° 4′; while the minimum, which was 22° 9′, occurred on the 28th. The range was 51° 5′. Barometric maximum, 30·198; minimum, 29·241. At 5.50 a.m., of the 22nd, a slight shock of earthquake was felt in Halifax, which was more severe towards the north and west of the province. Flocks of migratory thrushes (*Turdus migratorius*) were going south on the 10th. Although a cool month, the mean being 1° 61′ below the average; the extraordinary steadiness of the temperature and absence of severe frost in November concealed this fact. The warmest day was the 21st, maximum, 55° 5′; and the coldest the 16th, minimum, 18° 8′. The maximum barometric pressure was 30·366, and the minimum, 29·068. The rainfall was 5·19 in., and the prevailing wind N.W. In December the fall of snow was remarkably small; but the heavy rainfall raised the total precipitation to 5·77 in. The temperature gave results abnormal in the extreme. The maximum, 53° 8′, had never been touched for several years; while the minimum, 12° 2′, was unprecedently high. The 1st, which was the warmest day, had the mean heat of May; and the mean of no less than eight days was above 40°. Another peculiarity of this month was the frequent high reading of the barometer, marking over thirty and a half inches on two occasions; and fourteen days giving means over 30·000. The common N.W. wind scarcely obained prevalence over S.W. and W.

Dr. Bernard Gilpin read a paper "On the Canadian Porcupine" (*Erethison dorsatus*), in which it was stated that this very shy and retiring animal still exists in abundance in the province. His bones and teeth had been found in the Kjoekkenmoedding of the coast, proving that he varied the diet of the ancient people who made them. A very large specimen measured 25 in. in length, with quills of 3 in. The Indians consider them as good food, and have a very speedy way of cooking them; merely scorching off quills and hair, scalding in a pot of boiling water, then scraped, cut up, and fried. The porcupine soon becomes tame in confinement, readily eating all kinds of vegetables and fruit, and will make itself at home even in the lap of a child. It dens in the forest, under some old root, and the path it makes to the trees it barks for food may readily be discerned on the snow. It prefers the bark of the hemlock (*Abies Canadensis*) to any other food, and loves the most lonely and wild portions of the forest, avoiding the settlements, save in warm October nights, when it sometimes steals out into the clearing for the apples which lie around the trees of the orchard. The general colour of the porcupine is black, though a few long hairs tipped with white give it a greyish appearance. It is covered with spires from the forehead over the back, upper surface of the arms, legs, and tail; under surface of the arms and legs and belly has no spires, but is covered with dusky hair.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

Paris, June 13th.—A correspondent in the Section of Medicine and Surgery was elected at this meeting, to replace M. Panizza, lately deceased. Amongst the candidates for this appointment were, in the first line, M. Kokitanski, of Vienna; in the second line, M. Lebert, of Breslau; in the third line, and in alphabetical order, Mr. Bordman, of London, and M. Donders, of Utrecht; in the fourth line, Dr. Bennet, of Edinburgh, and Mr. Paget, of London. M. Kokitanski was elected, having obtained thirty-seven votes out of forty; M. Lebert obtained two votes, and M. Donders one.

Amongst the correspondence of the day was a paper by M. H. Caron, "On certain New Properties of Iron."

M. M. Martins and Chancel, in reply to some remarks of General Morin (relative to their former statements as to the rupture of hollow projectiles by the congelation of the water contained within them), said that the contraction of the steel by cold is slight in comparison with the dilatation of the water by congelation. A bomb, cast at a temperature of 12°, contracts only $\frac{1}{10}$th by the pressure which determined the rupture of the shell by the dilatation of the water. Although the two causes are contrary one to the other, the effect of one is so slight that it may be considered as unimportant in the calculation of the resultant effect.

A letter from Mr. Lockyer contained some observations on solar protuberances made by him on the 16th of May, a day on which these protuberances were very remarkable. Mr. Lockyer also remarks that these observations have led to a renewed confirmation of the views recently brought forward by him on the constitution of the envelope of the sun, and particularly with reference to the fact that the stratum in which these phenomena occur is of a very slight thickness.

M. Toselli brought forward a note, indicating a means for producing in a mass of water a lowering of the temperature to 13°. This process consists simply in plunging into the liquid a curved and spiral tube, and rotating it on its axis.

A paper relative to a grotto, called the *Grotte des Morts*, near Alais, was placed before the meeting. It contained statements with reference to the fact that this grotto, which was originally a mine, afterwards became a place of sepulture for the inhabitants of the surrounding district. Their remains are still to be found there—a fact which denotes even more clearly the age of that population.

M. Henri Sainte-Claire Deville presented a paper by the pupils of his laboratory, on "The Determination of the Mechanical Equivalent of Heat by means of the experiment of Foucault's Revolving Disk."

M. Wurtz presented a note by a medical student, M. Duboux, on "The Use of Atropine, in order to Distinguish Real from Apparent Death."

M. Cahours presented a note by M. Houzeau, on "A Process adapted to Produce Ozonization of the Air in a very simple and rapid manner."

M. Jamin brought forward the results obtained by him (in conjunction with M. Amaury) in his experiments for the determination of the specific heat of different liquids.

M. Marey placed before the meeting a small apparatus, by means of which the flight of insects and birds can be registered. This apparatus, which seems but a simple toy, is founded on mechanical laws,

and leads to a rational explanation of the movements by means of which flight is executed.

The meeting terminated with a memoir, on "The Treatment of Typhoid Fever with Creosote," which appears to be productive of good effects."

NOTES AND MEMORANDA.

Patent for a Cold Tinning Process.—M. Daubié, ironmaster, Blanc Murger Works, at Bellefontaine, in the Vosges, obtained in November last a patent for tinning by a cold process, in order to prevent oxidation of iron in general, and especially of iron wire, employed in the fabrication of cards and wire cloth, without altering its polish or rigidity. An addition to the patent was made on the 30th December. The inventor's chief object is to prevent the softening of the metal, and the mode adopted is successive immersion in baths containing cold solutions of salts of tin, with the addition of a certain amount of organic matter, such as fecula or starch, which has always been found valuable both in tinning and galvanization. The solution patented is composed as follows:—To every twenty gallons of water add 6 lb of rye flour, and let it boil for about half an hour; filter it, and afterwards add 212 lb of pyrophosphate of soda, 34 lb of crystallized salt of tin, 134 lb of neutral photochloride of tin, and from 3 oz. to 4 oz. of sulphuric acid. When the salts are dissolved the solution is distributed in eight or ten wooden vats, a little additional water being added to the first two or three of the vats. The wire is passed successively through the whole of the vats, and if great brilliancy of surface is required, also through draw plates at intervals, and the wire, while retaining all its rigidity, becomes covered with a brilliantly polished coat of tin. Beautiful and inoxidisable cards and wire cloth have been produced by this process, which is applicable to wire for a hundred different purposes. M. Daubié, we are told, has also succeeded in silvering iron wire, by using, in place of the salts of tin in the solution, cyanide of silver and cyanide of potassium.

Volcanic Eruption in Mexico.—The Mexican correspondent of the San Francisco *Bulletin* gives particulars of the recent eruption of Ceborruco. About fifteen miles north of Ahuacatlan, and east of the main road between Tepic and Guadalajara, is situated the mountain of Ceborruco, which, on the 22nd day of February, burst forth into five distinct volcanoes, vomiting ashes, sand, and large rocks with such violence and continuity as to cause the depopulation of the surrounding country. A white smoke is visible throughout the day; at night, a blue, sulphurous light, with occasional flames, crowns the summit of the Sierra, and, at intervals of ten or fifteen minutes, emitting puffs of (apparently) vapour, comparative to the sound of the blowing-off of steam from a boiler, followed by a dull roaring noise and trembling of the earth. The liquified rocks and earth run like creeks of water. The eruption increases in force daily, which, if continued, will endanger the town of Ahuacatlan. The inhabitants of the town and villages in the vicinity could not breathe from the effects of the fine ashes, which cover the ground and roofs of houses to the depth of over one inch. The fires are extending in the direction of Uzeta and and Tequepesban. Jala is in imminent danger. In close proximity to the present eruption, the remains of an old extinct crater are distinctly visible, evidently in its days having (of which no record exists among the Indians) far exceeded the powers of the late outbreak; a stream of lava, two miles wide by twelve miles long, presenting at a distant view the appearance of a wide carriage-road, descends from the old opening and terminates on the road, which creates a hollow, rumbling sound when passed over by the stage-coach. To date of 1st of April, no cessation or dimunition had been perceived; on the contrary, it was presumed to be augmenting in force and extent. The Indians in the neigbourhood believed it to be a vast gold and silver mine, and that the imps of darkness are having a grand reduction of metals. They profess to see black individuals in the blue flames, making merry over their productions at night.

The Lavatojo.—Although the olive is the most important produce of Italy, the means generally employed for extracting the oil are very imperfect, and lead to a considerable waste of oil, and until within the last five or six years, after the olives had been crushed by the peasants, the husks were abandoned as worthless; but in a few places steam machinery has been introduced to turn to account the husks thrown away by the peasants as worthless, and which it is now known represent a considerable portion of the value of the oil crop. The process of extracting the oil from the husks by a *lavatojo* is very simple. The husks are placed in tubs, and worked with water by machinery until the water has carried off all the remaining oily matters which rise to the surface after the water has been allowed to remain still. The husks are then put in a steam press, which squeezes out all the moisture; and after they have gone through these different processes, the husks are used for fuel. The *oleo lavato* thus extracted is used for the manufacture of soap.

SCIENTIFIC DIARY.

WEDNESDAY, June 22nd.

Geological Society, 8 p.m. 1. "Lower Portion of the Green-slates and Porphyries of the Lake District," by Dr. H. A. Nicholson. 2. "Observations on Some Vegetable Fossils," by Mr. R. Brough Smyth. 3. "Plesiosaurian Remains, Kimmeridge Bay," by Mr. J. W. Hulke. 4. "Geology of the Lofoten Islands," by the Rev. T. G. Bonney. 5. "*Pterygotus Hofmanni*, Germar, from the Marl-slate of Midderidge, Durham," by Mr. Albany Hancock and Mr. Howse.

Royal Society of Literature, 8 30 p.m. "Greek Tablet found in the Assasseef, Thebes," by Mr. W. R. Cooper.

THURSDAY, 23rd.

Royal Society Club, 6 p.m.

Statistical Society, 4 30 p.m. Anniversary Meeting.

Zoological Society, 8 30 p.m. 1. "Walrus," by Dr. Murie. 2. "Catalogue of the Mammals of South China and Formosa," by Mr. R. Swinhoe. 3. "Birds from Trinidad," by Dr. O. Finsch.

FRIDAY, 24th.

Quekett Club, 8 p.m.

SATURDAY, 25th.

Royal Botanic Society 3.45 p.m.

SUNDAY, 26th.

Sunday Lecture Society, 8 p.m. "On Cruelty in relation to the Lower Animals," by Spencer Cobbold, Esq., M.D., F.R.S., F.L.S.

MONDAY, 27th.

Ethnological Society, 8 p.m. (Extra Meeting.) 1. "On the Opening of the Park Cwm Tumulus," by Sir John Lubbock, Bart., M.P., F.R.S. 2. "On the Opening of Grim's Graves, Norfolk," by Canon Greenwell. 3. "On the Discovery of Platycnimic Men in Denbighshire," by W. B. Dawkins, Esq., M.A., F.R.S., and Professor Busk, F.R.S.

London Institution, 4 p.m.

TUESDAY, 28th.

Royal Medical and Chirurgical Society, 8.30 p.m.

Birmingham Natural History and Microscopical Society, 7 30 p.m. "Glimpses of Insect Life," by W. G. Blatch.

WEDNESDAY, 29th.

Society of Arts, 8 p.m.

NEW ZEALAND TOMBS.—"W. M."—We are obliged to our correspondent for the block, and shall reproduce it, as we suppose he intended. H. will be aware that we have already reproduced two others from the interesting volume from which it is taken.

SUNDAY LECTURES.—"Inquirer."—Communicate with the Secretary, Mr. Domville, who will give you every information, and will show you every courtesy. The Society owes much to its energetic Secretary for the manner in which he has conducted its affairs during the session now nearly concluded.

PROVERBIAL PHILOSOPHY.—"T. B."—It is quite out of our line, but the joke "Natura non fecit per saltum (Nature is not worth its salt)" is a poor one.

THE FERTILIZATION OF THE OVULE.—"H. H." is thanked for the specimens. Nægeli and Schleiden are the two who have done most work on the particular point referred to.

INSULATION OF CABLES.—"W. C."—Consult Mr. Varley or Professor Fleeming Jenkin. The law is easily demonstrated. The B. A. unit is most useful for the purpose; but your application of it is altogether a mistaken one.

CHROMATIC *v.* SPHERICAL ABERRATION.—"C. G. E."—We cannot conceive such a condition of things possible. If, as you say, you "have increased the penetration, and also at the same time diminished the aberration of sphericity," then the thing is a paradox to us; for in our opinion the quality of penetration is in a definite direct ratio to that of spherical aberration. The colours produced, and which you say always appear in the same order as those of the spectrum, is an extremely suspicious phenomenon. If it were due to the fact that undulations of a certain wave-length only pass through certain parts, is it not against all theory of probability that these thicknesses should be in such relation as to join the colours in the spectrum order?

THE CINCHONACEÆ.—"V. Y."—They are corollifloræ, and allied to the madders.

MANUFACTURE OF DEXTRINE.—"A. S."—Consult Ure's dictionary.

THE SEPARATION OF DOUBLE STARS.—"R. J. G." will find the information in Proctor's "Half Hours with the Stars," published by Hardwicke, of Piccadilly.

WEDNESDAY, JUNE 29, 1870.

PROFESSOR HUXLEY AND DR. PAVY.

IN the discussion which has taken place in the pages of the *Lancet* between Dr. Pavy on the one hand, and Professor Huxley on the other, a point has been raised in which the scientific public generally are considerably interested. For a long time there has been abroad a vague impression to the effect that those who have had to do with the examinations in the London University have attempted to give that institution a false *status* by causing the questions put to candidates for degrees to be of so high a standard, that but few students could possibly answer them. This idea has been especially prevalent among the teachers in our metropolitan medical schools; and we are not at all surprised, therefore, that it should have fastened itself on Dr. Pavy, who has distinctly expressed his opinion on the subject in a letter addressed to the *Lancet*. Indeed, Dr. Pavy, in commenting on the remarks which fell from Professor Huxley in his recent address to the students of University College, has attributed the grievance which Professor Huxley alluded to, to the method of examination which the Professor and his colleagues at the University have adopted.

The charge is a very grave one, and we are not surprised to find that Professor Huxley has lost no time in rebutting it, and that he has successfully shown how mistaken is Dr. Pavy's explanation. Statistics of the results of the examination at the London University have been carefully prepared by Dr. Carpenter (the Registrar); and from these Professor Huxley demonstrates that the evil does not result from the character of the examination-papers, as Dr. Pavy considers. Indeed, Professor Huxley is still of opinion that the ignorance of students results from the mode in which Physiology is taught in the medical schools. The substance of Professor Huxley's reply will be found elsewhere in our columns; and we think that our readers will conclude with the Professor that, whatever may be the reason of the prevailing ignorance of physiology—whether it be due to imperfect teaching in the schools, as Mr. Huxley supposes, or not—it is not attributable to the system of examination. We have had, on one occasion, to complain of the number and character of questions put, in certain departments of science, to candidates for the University of London matriculation; but, from a long experience of the questions given in the departments of Biology, we must confess that it has always seemed to us that the examiners conscientiously sought to find out how much, and not how little, the candidate knew. We think, therefore, that, so far as the discussion has extended, Professor Huxley's position has not been successfully assailed.

But, leaving aside altogether the respective opinions of the two disputants, we would ask the question, Is Physiology properly taught in medical schools generally? We doubt not that in some of the larger hospitals and colleges much attention is directed to those facts and phenomena in practical Physiology on which Medicine itself is so firmly based. But is it not the case that in others, a few antique diagrams, preposterously unnatural models, utter absence of anything like real demonstration, and unnecessary dwelling on speculations and effete hypotheses, constitute the whole teaching of the subject of Physiology? How many lecturers are there in London even, who demonstrate the circulation of the blood, or show the passage of the chyle along the lacteals, or make their students familiar with the normal heart and lung sounds, or with the difference between the anterior and posterior roots of the spinal nerves, or show the action of constant galvanic currents as compared with inductive ones, or familiarize their pupils with the result of section of the spinal cord at different points? We should like, indeed, to know. No doubt, numerous lectures on the cell theory are given; "reflex action," as an hypothesis, is adequately dwelt on; the relative claims of Servetus and Cæsalpinus to the discovery of the circulation are disposed of, and no end of text-book quotations are indulged in.

This is unquestionable; but it is not teaching physiology as it ought to be taught; and as it is the system usually followed in nine cases out of ten in these countries, Professor Huxley was perfectly justified in pointing it out, and passing the severest censure upon it. That Professor Huxley's view is right we do not for a moment doubt, and we thank him heartily for the courage and candour with which he has exposed a system, not only detrimental to the advance of abstract science, but most pernicious in its influence on the present generation of medical men, since it cultivates a tendency to accept the assertions of books rather than to observe the phenomena of disease.

THE WEEK.

VARIOUS correspondents have kindly expressed their regret that the present Editor should cease to hold the reins of SCIENTIFIC OPINION. We thank them for their good feeling. Much of the success which has attended our labours has been due to the generous help and friendly advice, suggestion, and encouragement held out by our correspondents, and especially by one who, we do not hesitate to say, is the first man of Science of the age. But, in retiring from the Editorial chair, we do so not without a feeling of relief, even if tinged with regret at losing pleasant intercourse with many respected colleagues. The task of conducting a weekly journal, which shall not, as certain journals are, be as it were pitch-forked together, and of so considering the current of politico-scientific questions as to be enabled to help public opinion on its way to reform, is so arduous, so unceasing, attended with so much anxiety, and such intense unrest, that after nearly two years of editorial toil, we lay down our burden and are glad to be able to put in practice the old aphorism, "Rest and be thankful." We believe that our successor will not lose sight of the interests of those who have so long and so favourably supported SCIENTIFIC OPINION, and in resigning to him the Editorial chair, we bid a kind adieu to our old friends and wish our future representative God-speed in all heartiness and goodwill.

ON Thursday afternoon, the 23rd instant, several members of the Geologists' Association, accompanied by their president, Professor Morris, visited the neighbourhood of Watford. Alighting at Bushey Station, they first examined the chalk pit close to the railway. A good section of the Upper Chalk, on which Watford is situated, is here seen; and overlying it, a pebble bed of the Woolwich and Reading series, has recently been exposed. This bed completely thins out in the pit, and is succeeded by clay-drift and sandy gravel (terrace gravel), which repose, in other parts of the pit, immediately on the chalk. The Chalk Hill pit, which furnished instructive examples of "pipes," was next noticed; and then the party proceeded to Watford Heath Kiln, where they were joined by Mr. W. T. Stone, who showed the sections then exposed, and explained how they varied in parts of the pit not now worked. Professor Morris had previously explained the general features of the country, especially with reference to the form of the ground, and general contour of the hills, as caused by denudation acting on what were originally weak lines of resistance. The London Clay, with its basement bed, and between it and the Chalk, a series of beds of sand and clay (with associated pebble beds), which were considered to represent the Woolwich and Reading series (and possibly also the Thanet Sands), are here seen. They are not nearly so highly developed as on the south of the Thames, being entirely marine, and only about 40 ft. thick; while, on their southern outcrop,

where fresh-water beds are intercalated with the marine, the Woolwich series and associated beds attain a greater thickness. In the London Clay basement bed Mr. Stone has found several rare fossils, among which a mammal's tooth (*Hyracotherium leporinum*, Owen) was particularly noticed. After obtaining several fossils from this bed, the party proceeded to Bushey Kiln, where a section, somewhat similar to the last, but with an additional bed of clay, with "race," and showing, in the lower portion, alternating beds of sand and pebbles, is exposed. After a delightful country walk, Berry Wood, near Aldenham, was reached. Here the chalk is covered by thick beds of flint and pebble gravel; and by the roadside some Silurian boulders, one deeply scratched, and other rocks, attested the proximity of the boulder clay, which, in Bricket Wood, about three miles to the north, is from 20 to 30 ft. thick. In Berry Wood is a chalk pit, abounding in the remains of sponges, surrounded by more shells of flint, and containing "spicules," Foraminifera, and even Polyzoa, beautifully preserved. Once in this pit it was difficult to leave, every "find" seeming better than the last; every sponge, or Ventriculite, more beautiful in structure. But the sun had set, and the approaching darkness warned that this attractive spot must at last be left. By a short cut across the fields Watford Station was soon reached, and the party returned to London, after one of the most successful and enjoyable excursions of the season.

A MEETING of the Sunday Lecture Society will be held at Freemasons' Hall, on the 7th prox., when the Committee will present a report of the result of the Society's first year's operations, and will state their intended future arrangements. The last lecture of the Society was delivered on Sunday evening, by Dr. Spencer Cobbold, F.R.S., to a large and enthusiastic audience. Dr. Cobbold took for his text the subject of Cruelty to Animals, and contended that animals with no distinct nervous fibres could feel no pain. Dr. Cobbold's eloquence was effective, and was in advance of his physiology.

THE Report of the Cambridge Observatory has just been issued, from which it appears that meridian observations with the transit instrument have been discontinued since July last, when that instrument was removed, to prepare for the reception of the new transit circle; but there has been considerable delay in finishing this instrument, owing to defects in the material of the pivots, so that it is not yet mounted. A satisfactory series of places of Winnecke's comet were obtained in May and June, 1869, and the reduced observations of that and several other comets are ready for press, as well as the results of observations of Mercury, and of 1,007 stars observed for the purpose of completing the Marknee zones.

THE second summer fête of the Royal Botanic Society was opened last week. The show of flowers was very fine, the scarlet pelargoniums, the orchids, *Cattleya Warnerii*, *Anguloa Clowesii*, *Lælia Purpurata*, and *Dendrobin Formosum* attracting special attention. In the centre of the grand marquee were groups of curious new and rare plants, fine petunias and gloximas.

A NUMEROUS and influential meeting, called by private circular, has been held at Stafford House. The Duke of Sutherland was called to the chair. Sir Roderick Impey Murchison moved and Mr. Edward Gordon, Q.C., M.P., seconded the following resolution:—"That this meeting cordially approve of the proposal to endeavour, in some suitable way, to perpetuate the memory of Sir James Simpson,—one who has done so much for scientific medicine, and to assuage the sufferings of the human race." It was moved by the Earl of Dalhousie, and seconded by Mr. George Dempster, of Skibo, "That, without undervaluing the proposal that has been made to erect a statue in the metropolis of his native country, this meeting is of opinion that no commemoration of a man so eminently practical would be complete which did not embrace the establishment of an hospital where the diseases peculiar to females could be treated, which every friend of the late Sir James Y. Simpson knows was an object ever near his heart." It was moved by Mr. W. Cowper-Temple, M.P., and seconded by Lord Ronald Leveson-Gower, M.P., "That this meeting is of opinion that a committee should be formed in London, to co-operate with the other committees, and to secure the establishment of a suitable and lasting memorial of the fame and character of the deceased, and that the following gentlemen constitute said committee, with power to add to their number." The Marquis of Westminster moved and Mr. Arthur Kinnaird, M.P., seconded a resolution that the Duke of Sutherland be requested to act as chairman of the committee. Mr. Archibald Campbell Swinton, of Kimmerghame, moved, and Dr. J. Rindon Bennett seconded a motion that Mr. Arthur F. Kinnaird, M.P., be requested to act as honorary treasurer, and the Right Hon. Lord Elcho, M.P., and Dr. William Playfair and Dr. Black be requested to act as honorary secretaries of said committee. These resolutions having been unanimously agreed to, the thanks of the meeting were awarded to the chairman, on a motion by Sir George Warrender, seconded by Mr. John Pender, of Minard. Dr. Priestley, after expressing his gratification with the proceedings, and speaking in warm terms of Sir James Simpson's kindness to all, and especially to members of his own profession, suggested that an hospital was, perhaps, not the best form which the proposed memorial could take, as Sir James Simpson had expressed objections to the erection of another hospital in Edinburgh, except under certain special conditions. Dr. Alexander Wood, of Edinburgh, defended the decision of the Edinburgh Committee, and dwelt upon the exertions which Sir James Simpson had made to get the Edinburgh Maternity Hospital put on a permanent and proper footing. It was ultimately agreed to leave the matter in the hands of the sub-committee.

THE session of the Agricultural College of Cirencester has terminated. Mr. Holland, chairman of the committee of management, distributed the prizes, &c., last week. The college diploma was awarded to the following students:—H. Willett, Lewes; Alberto G. Granados, Bonn, Prussia; C. H. Jackson, Darlington; J. Edwards, Trentham Rectory, Stoke-on-Trent; first scholarship to Ashcroft, Ohrly, and Sturge; second scholarship to Smith, Blackett, and Bourdillon.

WITH the utmost regret we have to announce the death of Professor Syme, of Edinburgh, whose state of health we reported in our last and preceding issues.

DR. PAVY having, in a letter to the *Lancet*, complained that the want of knowledge of practical physiology in candidates who present themselves at the London University [and to which Professor Huxley adverted in a recent address], is due to the character of the questions put by the examiners, Professor Huxley publishes the following pertinent remarks in Saturday's *Lancet*:—"Dr. Pavy seems to have forgotten that the accuracy of this statement can very easily be tested. I invite him to turn to the Calendars of the University of London for the last five years, and to point out any questions in the physiological part of the pass examination for the M.B. degree, which could not be satisfactorily answered by any one possessing a knowledge of the 'fundamental principles' of human physiology. There is another mode of ascertaining whether the requirements of the examiners in physiology have been exorbitant or not, and that is by comparing the proportion of rejections in physiology alone with the total number of rejections. Dr. Carpenter, the Registrar of the University of London, has been kind enough to have the subjoined tabular statement prepared for me; and you will observe that it yields the following results:—Out of 156 candidates who came up for the entire examination in the five years, 1865—1869, only *one* was rejected for his want of knowledge of physiology, when he would have passed in all the other subjects. And, taking the average of the five years, the number of cases in which the physiological examiners have seen reason to concur with their

colleagues in rejecting candidates does not amount to more than 17 per cent. of the total number. Of the candidates who have been examined in physiology only, the number rejected amounts to about 19 per cent., or nearly the same proportion. It may seem strange that those who come up for examination in physiology only, should be rather worse prepared than those who take the whole examination. But the fact that a candidate comes up for examination in physiology only, thereby sacrificing all chance of honours, shows one of two things; either that he is conscious of inferior capacity, or that circumstances prevent him from devoting himself completely and uninterruptedly to his studies. In conclusion, I submit, that the fact that more than four candidates out of every five, who have come up for the degree of M.B. at the University of London, have been able to satisfy my colleagues and myself, is *primâ facie* evidence that our standard has not been pitched too high; and, unless Dr. Pavy can cite pass questions of ours which could not be answered by a moderately well-instructed student, I shall take the liberty of thinking that the charge which he has brought against Mr. Savory, Mr. Power, and myself is wholly devoid of foundation.

The prize of 2,000 lire, offered by the Medico-Chirurgical Society of Bologna for the best work on the "Advancement of Surgical Science by Italians during the present Century," has been awarded to Professor Corradi.

Pantatype (type for all), the *Stationer* says, is the name given by Messrs. Schonert, at Leipzig, to a new invention which is represented to change all graphic works executed for copper engraving and litho-press into raised plates, that may be immediately used for ordinary letterpress printing. The plates are said to be clear and durable.

The inauguration of the pleasure-grounds of the Summer Garden Society, situated within about a quarter of a mile of the Willesden Junction station on the North London Railway, was, the *Gardener's Chronicle* states, celebrated recently. These gardens have been established by a body of working men, under the title of the Summer Garden Society, and will be conducted on a principle popular on the Continent, under the management of Mr. Henry Bolleter.

The statement of a scientific contemporary that Oxford offered Mr. Darwin the D.C.L. degree is not quite correct. Three names were sent up as proposed, Mr. Darwin's being one. At first all three were rejected; but after a while the University felt ashamed of itself, and, repentant, consented to give the D.C.L. to Mr. Darwin—who, we doubt not, does not care one jot for an honour so tardily awarded. Priestcraft is still too rife in England.

We understand that, in resigning the Lectureship on Chemistry at Guy's Hospital, Dr. Taylor will continue his duties as Lecturer on Medical Jurisprudence.

Sir James Alderson, Sir William Jenner, Dr. George Paget, Dr. Bence Jones, and Professor Frankland have received the honorary degree of D.C.L. from the University of Oxford, at the commemoration held last week.

A few copies of Mr. Mayall's portrait of the President of the Photographic Society of London remain on hand, and can be procured by members who have not yet received the presentation print, either by making application to the publishers, Messrs. Taylor & Francis, Red Lion-court, Fleet-street, or, if required to be sent by post, by addressing the Honorary Secretary of the Society, J. Spiller, F.C.S., 35, Grosvenor-road, London, N., and inclosing twelve stamps to defray the cost of millboards and postage.

The editorship of *Licht*, one of the Berlin photographic journals, has recently passed into the hands of Dr. Franz Stolze, who gives us, in the last two numbers, his ideas on the construction of the photographer's studio, explained by the help of woodcuts, and treated mathematically. A very fine illustration, printed by Gemoser's Lichtdruck process, from a negative by Carl Suck, was, according to the *Photographic Journal*, recently issued with that journal.

The Minister of Public Instruction in Italy has promised a grant of 1,600 *lire* towards the expenses of instituting a laboratory of Cryptogamic Botany in Pavia; and it is hoped that a contribution will also be received from the Minister of Agriculture.

We understand that in consequence of the protest entered by Professor Wanklyn and Dr. Paul against the course taken by the Sewage Committee, to whose proceedings we referred the week before last, the remainder of the Committee has requested the Council of the British Association to appoint a Provisional Committee to administer the fund subscribed by towns for the investigation of the sewage question. We presume this step must be understood to mean that these members of the Committee are not disposed to carry out the intention they had expressed of devoting their personal attention to the work. Considering the conditions under which the fund was raised, it evidently cannot be applied in payment of persons, not being members of the Committee for conducting the required investigations, nor can we perceive how the Council of the Association, or even the Association itself, can appoint a Committee to administer the fund, inasmuch as its collection was a matter quite outside the powers conferred by the Association on its Committee.

ON THE DESCENT OF GLACIERS.

BY THE REV. HENRY MOSELEY, M.A., F.R.S., CANON OF BRISTOL AND INSTIT. IMP. SC. PARIS CORRESP.

In Two Parts.—Part II.

All Alpine travellers, from De Saussure to Forbes and Tyndall, have borne testimony to the intensity of the solar radiation on the surfaces of glaciers. "I scarcely ever," says Forbes, "remember to have found the sun more piercing than at the Jardin." This heat passes abruptly into a state of intense cold when any part of the glacier falls into shadow by an alteration of the position of the sun, or even by the passing over it of a cloud. Now the Mer de Glace moves faster by day than by night. Its mean daily motion is twice as great during the six summer as during the six winter months. The connection between its rate of motion and the external temperature is most remarkable. It has been carefully observed, and the results as recorded by Professor Forbes leave no doubt of the fact, that no change of external mean temperature is unaccompanied by a corresponding change of glacier motion. From this it follows that the two are either dependent on some common cause, or that the one set of changes stands in the relation of a cause to the other. That both sets of phenomena—the changes of the sun's heat, and the changes of glacier motion—should be due to some common independent cause, seems impossible. We are forced therefore on the conclusion that one is caused by the other. And as the changes in the glacier motion cannot cause the changes of solar heat, it must be the changes of solar heat which cause the changes of glacier motion. The *sun* is obviously *master* of the glacier. Nor is this to be considered a startling or improbable conclusion. Heat is but another form of mechanical power. This power is constantly streaming into the glacier; for ice is diathermanous. It is readily penetrable by luminous heat. This has been shown by Tyndall, who, having sent a beam of heat through a block of Wenham Lake ice, saw its course starred by the dilatations of the ice. I have, moreover, myself obtained an ice lens by causing ice to be turned in a lathe to a spherical surface by

means of a templet of iron. Through this lens the rays of the sun streamed in abundance, and were concentrated in its focus with such intensity as to burn the hand and instantly set fire to a match. There can be no doubt therefore that the rays of the sun, which in those Alpine regions are of such remarkable intensity, find their way into the depths of the glacier. They are a *power*, and there is no such thing as the loss of power. The mechanical "work" which is their equivalent, and into which they are converted when received into the substance of a solid body, accumulates and stores itself up in the ice under the form of what we call elastic force, or tendency to dilate, until it becomes sufficient to produce actual dilatation of the ice in the direction in which the resistance is weakest, and by its withdrawal to produce contraction. How much heat entering the surface of a glacier is necessary to this result has been made the subject of calculation. Supposing the depth of the ice to be the same as that at the Tacul, its motion at different depths that which Tyndall found it to be there, and its surface motion that which he measured lower on the Mer de Glace at Les Ponts, and supposing the resistance to shearing of ice to be 75lbs. per square inch; then the mechanical work, which acting within the mass is necessary to put the glacier in motion, as it actually moves, is 61¾ units of work per square inch of the surface of the glacier per day.[1] Now this quantity of work would be supplied by ·0635 heat-unit entering the ice per square inch of surface per day and diffusing itself through it, each heat-unit being the heat necessary to raise 1 lb. water by 1° F. Far more than this heat probably passes the surface and enters into the ice of a glacier on days such as that when the motion was observed which serves as a basis of these calculations.

But *how* does this mechanical power, which thus streams continually into a glacier when the sun shines on it, compel its descent?

The fact of the descent of a sheet of lead when placed upon the inclined surface of a roof, however low the pitch, especially in summer, has long been known; I myself first observed it on the southern side of the roof of the choir of the Bristol Cathedral, in 1855. I have verified it by the following experiment:—I fixed a deal board 9 ft. long and 5 in. broad to the southern wall of my house, so as to form an inclined plane, and upon it I placed a sheet of lead, turning its edges down over the side edges of the board, and taking care that it should not bind upon them, but be free to move with no other obstruction than that which arose from its friction. The inclination of the board was 18° 32′, the thickness of the lead ⅛ in. its length 9 ft., and its weight 28 lb. The lower end of the board was brought opposite to a window, and a vernier was constructed which could be read from within, and by which the position of the lead upon the board could be observed to the 100th of an inch. I began to measure the descent of the lead on the 16th of February, 1858, and recorded it every morning between seven and eight o'clock, and every evening between six and seven o'clock, until the 28th of June. I have preserved all these observations. In the night, between sunset and sunrise, the lead scarcely descended at all. It was on days when the thermometer in the sun varied its height rapidly and much—as on bright days with cold winds, or when clouds were driven over the sun—that the descent was greatest. So remarkably, indeed, was this the case, that every cloud which shut off the sun for a time from the lead, and every gust of wind which blew upon it in the sunshine, seemed to bring it down a step. On such days it would descend from ¼ to ½ an inch. On the contrary, when the sky was open and clear, and the heat advanced and receded uniformly, the descent was less, although the difference of the extreme temperatures of day and night might be greater. It was least of all on days of continuous rain. The sun was the obvious cause of the descent of the lead. It was master of the lead, as it is of the glacier. A dilatation and contraction of it was caused by the passage into it, and the withdrawal, of the sun's radiant heat, and this dilatation and contraction of the lead caused it to descend. Why it should do so may be easily explained.

Now, the theory of the descent of the glaciers, which I have ventured to propose, is that they descend, as the lead in the experiment does, by reason of the passage into them and the withdrawal of the sun's rays, and that the dilatation and contraction of the ice so produced is the proximate cause.

There is no substance, the dilatation or contraction of which, by changes of temperature, is more thoroughly and accurately known than that of ice. Experiments were made upon it by three independent observers, at the observatory of Pultowa, in the winters of 1845 and 1846, between the temperatures of 0·9 R. and 28·82 R., from which it resulted that ice is by far the most dilatable of all known solid substances, being nearly twice as dilatable as lead. These experiments have been described by Baron W. Struve, in the *Transactions of the Academy of St. Petersburg*.

The ice of a glacier behaves itself in its descent exactly as the lead did in my experiment.

It has been argued, in opposition to this theory, that the temperature of the ice of glaciers is, by the observations of Agassiz, but very little below 32°, and that, if radiant heat found its way into it, it would not expand, but melt it. To this there is the obvious answer, that radiant heat does find its way into ice as a matter of common observation, and that it does not melt it, except at its surface, and therefore that it *does* dilate it. Blocks of ice may be seen in the windows of ice-shops with the sun shining full upon them, and melting nowhere but on their surfaces. And the experiment of the ice-lens shows that heat may stream through ice in abundance—of which a portion is necessarily stopped in the passage—without melting it, except on its surface. My theory supposes that the ice beneath the surface of a glacier is a *solid*. That is all.

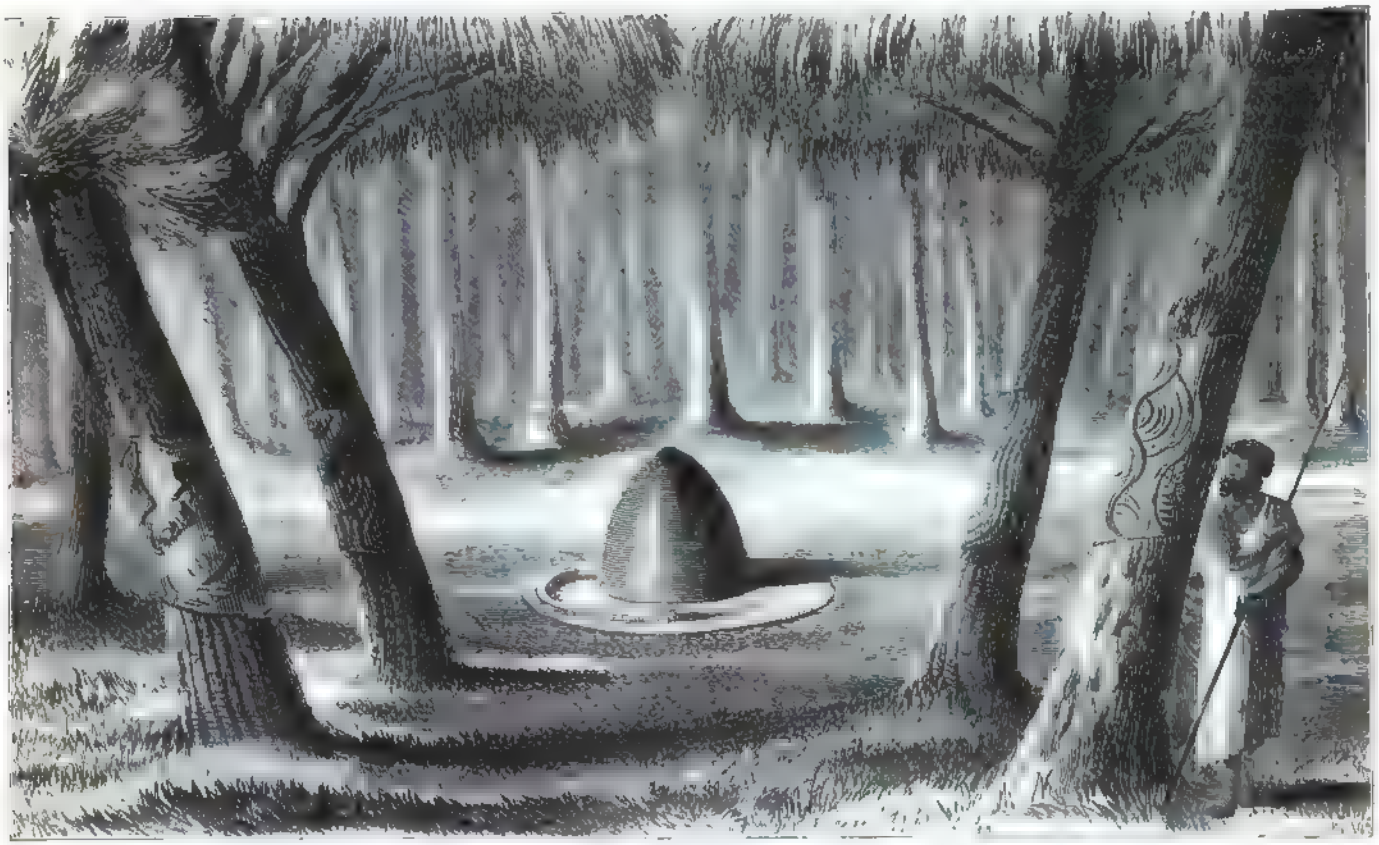
Being a solid, and receiving into its substance heat—that work—in great quantities, that work (by the principle of the conservation of force) cannot but be stored up in it, under the form of "potential energy," and wherever it is present, produces a tendency to dilatation. When that tendency takes effect, it is in the direction of the least resistance to the dilatation of that part. It matters not whether the temperature of the ice be below 32° or above it, provided only that the condition of solidity be satisfied. Being a solid, it cannot but dilate and contract under the variations of temperature to which it is subjected; and, dilating and contracting, it cannot but descend. To show that the ice of a glacier does not dilate when heat is received into it, it would be necessary to show it not to be subject in this respect to a law common to all other solid bodies.

Great alternations of temperature are *not necessary to cause* the motion of a glacier. A succession of *small* alternations produces the same effect as one great one. Their effect is cumulative. Alternations backwards and forwards, of 2° each, six times repeated, would carry the glacier (under certain assumed conditions) as far down as a single alternation of 12°.

The observations of Agassiz on the temperature of the ice of the Aar glacier in 1841, 1842, were made in borings from 15 to to 200 ft. deep. Thermometers placed in these borings never fell below 0·3 C., although the external temperature descended at night to 5° or 6° C. Commonly they showed exactly zero.[2] Nothing can, however, be concluded from these experiments, because the thermometers were not *frozen into the ice* of the glacier, or the mouths of the borings so effectually stopped as to prevent the access of air or the percolation of water from the disintegrated ice near the surface. The maintenance of a constant state of humidity in the air of the boring not being thus provided against, the included thermometer could not but remain at zero, however low might be the temperature of the

[1] Proceedings of the Royal Society, January, 1860, p. 207.

[2] *Bulletin de Genève*, tom. 44, p. 249.



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surrounding ice. For the water of the contained air freezing on the sides of the boring (like hoar frost) would raise the temperature around the bulb, by the latent heat set free in freezing, to zero C. And the humidity of the air being continually renewed, this process would always go on.

"A thermometer is, in short, incapable of taking the temperature of ice, unless that ice be dry."[3] These are the words of that eminent man, Principal Forbes, in the last (I think) of his papers on the subject of glaciers.

On a Friday evening like *this*, eight years ago, another eminent man, whose loss to science we all deplore, addressed the audience then assembled here on the subject on which I have now been addressing you. He possessed every accomplishment for the investigation of it, and had studied it long and successfully; he was versed in physics, and was an able and original mathematician. I speak of Mr. William Hopkins, whose name will always be held in honour by reason of his many contributions to the science of glaciers, and especially because of the explanation he first gave of the formation of crevasses. In the introductory part of the discourse which Mr. Hopkins then delivered, he "insisted on the necessity of a more exact definition of terms and more accurate modes of mathematical reasoning, than those which had, up to that time, characterized the discussion of glacial phenomena."

That, on the necessity of which he insisted, and for which he laboured, I also have laboured for. I have sought to bring the discussion of glacial phenomena out of the wide region of scientific opinion, and place it in that of exact science. That work is, however, still far from being completed. Life, too, is short, and the power to pursue studies such as these is sometimes shorter in duration than life itself. But other workers are behind.—*Lecture delivered before the Royal Institution.*

[3] Forbes, *Phil. Mag.*, March, 1859.

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THE above illustration shows a New Zealand graveyard, if we may so term it. It will be seen that, besides the curious central mound, there are certain hieroglyphics engraved upon the neighbouring trees. The cut is taken from the Rev. Mr. Taylor's *Ti Ika a Maui*, a work some time since noticed in these columns, and in which an interesting account of this subject will be found by those curious in such matters.

REVIEWS OF BOOKS.

Contributions to the Theory of Natural Selection. A Series of Essays, by ALFRED RUSSELL WALLACE, author of the *Malay Archipelago*. London: Macmillan & Co.

MR. ALFRED WALLACE has, in the volume of essays now published, first given to the world in a comprehensive form the several memoirs which have during many years past appeared from his pen in the scientific periodicals. It will be known to all of our biological readers that the doctrine now so familiar as the Darwinian theory of Natural Selection was really promulgated by Mr. Wallace a short time before it was more elaborately stated by Mr. Darwin himself.

Both of these eminent naturalists had simultaneously and independently worked out the great problem of the origin of species; but Mr. Wallace, with unusual modesty, and with a profound admiration of Mr. Darwin's great qualifications as the advocate of a new law in biology, gave way to him, and allowed him to have, so far as the outside public are concerned, the credit of establishing the doctrine of Natural Selection. We should not be doing justice to Mr. Wallace's extreme modesty, if we did not here quote a passage from the preface, in which he states clearly the position he has taken:—

"The present work will, I venture to think, prove that I both saw at the time the value and scope of the law which I had discovered, and have since been able to apply it to some purpose, in a few original lines of investigation. But here my claims cease. I have felt all my life, and I still feel, the most sincere satisfaction that Mr. Darwin had been at work long before me, and that it was not left for me to attempt to write 'The Origin of Species.' I have long since measured my own strength, and know well that it would be quite unequal to that task. Far abler men than myself may confess that they have not that untiring patience in accumulating, and that wonderful skill in using large masses of facts of the most varied kind—that wide and accurate physiological knowledge—that acuteness in devising and skill in carrying out experiments—and that admirable style of composition, at once clear, persuasive, and judicial—qualities which in their harmonious combination mark out Mr. Darwin as the man, perhaps of all men now living, best fitted for the great work he has undertaken and accomplished."

In this volume we find the collected essays of the author which bear especially on the great question of the origin of specific forms. Most of these have already appeared in scientific and popular journals, some having been published in the *Student* and the *Westminster Review*; but certain of them, as that on "Instinct in Man and Animals," are now printed for the first time. In all the chapters we note the same wonderful collection of observed facts, the same close and clear reasoning from data to conclusions, the same patience, and the same candour in acknowledging difficulties which characterize Mr. Wallace's other writings. Taken collectedly, these essays form a most valuable supplement to Darwin's "Origin of Species," beside which Mr. Wallace's book should be placed on every biologist's bookshelves. It would be impossible to select any one of Mr. Wallace's chapters in preference to another for interest or value; but there are certain of them that have for us a peculiar attraction; among these are the paper on birds' nests, which develops an important theory of instinct, that doubtless will find many opponents among the religiously orthodox; and the chapter on the "Limits of Natural Selection as applied to Man," in which the author discusses the question of an abstract moral sense, and treats of the question of volition. On many of these points Mr. Wallace takes views from which we, and many others of his admirers, must distinctly dissent. Nevertheless, his remarks are highly philosophic, and may be read by all without the least feeling of offence. We note in connection with this part of the subject that Mr. Wallace accepts, with much enthusiasm, the remarkable and well-known theories of the Jesuit writer, Bayma. In conclusion, we must say of the work that it is an admirable pendant to Mr. Darwin's classic treatise.

Mammalia: their Various Orders and Habits Popularly Illustrated by Typical Species. By Louis Figuier. London: Chapman & Hall. 1870.

MESSRS. CHAPMAN & HALL have almost constituted themselves the English publishers of the Figuier popular Natural History works. The present volume is certainly the most popular and least scientific work of all the series, and deserves little serious notice at our hands. There is a very elementary introduction on the characters of the Mammalian group; and then we find a description of the different species. This account, however, is so absurdly adapted to the juvenile mind that it reminds us of the old school reading-books, in which a picture of a lion (taken from the Euston-road School of Sculpture) stood above the statement that he "is the most ferocious of all the beasts of the field." M. Figuier's Mammalia is a nice book for young boys; but as a work on Mammalia, even for unscientific grown-up people, it is utterly unadapted to its purpose.

Algebraical Exercises and Problems: with Elliptical Solutions. By Hugh McColl. London: Longmans. 1870.

THIS appears to be a well-arranged, clear, and useful little manual. The exercises are well selected and numerous, and the solutions are given so fully that even one ignorant of algebra may learn its rudiments from Mr. McColl's lessons without the assistance of a master.

On Microscopic Manipulation: being the Subject-Matter of a Course of Lectures delivered before the Quekett Microscopical Club, January–April, 1869. By W. T. Suffolk, F.R.M.S. London: Gillman. 1870.

IT will doubtless be gratifying to the members of the Quekett Club to see these lectures of Mr. Suffolk's reprinted from the pages of the *Chemical News*. And it must be pleasant to the *amour propre* of Mr. Suffolk to see his words made into a handsome and well-printed little manual. But can we say anything more favourable than this? We fear not. The matter as a whole is accurate; and the work will be found useful, though the illustrations are miserably few in number. Still, with books like Carpenter's, Beale's, Hogg's, and Davies's excellent little work on the preparation of microscopic objects, this volume was not wanted. It contains hardly anything that cannot be found better stated in some of the works referred to, and it is devoid of the great mass of valuable information which they contain. We cannot approve of a compilation of this kind, and we should be unfair to our readers if we were reticent of our candid opinion.

Researches on Diamagnetism and Magne-Crystallic Action, including the Question of Diamagnetic Polarity. By John Tyndall, LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution. London: Longmans, Green, & Co. 1870.

THIS is the first instalment of a re-publication of the author's Memoirs on Experimental Physics. Although this volume is only a reprint of papers which have appeared already in the pages of the *Philosophical Magazine* and of the *Philosophical Transactions of the Royal Society*, it will have to many students of physics the value of an original treatise on the difficult and recondite subjects of diamagnetism and magne-crystallic action, as we have here a connected series of researches which exhibit the progress of the development which our knowledge of these magnetic phenomena have undergone in the hands of Faraday, Tyndall, and others, in a way which the separate memoirs can only have done to very few.

The volume includes six Memoirs—"On the Magneto-optic Properties of Crystals and the Relation of Magnetism and Diamagnetism to Molecular Arrangement;" "On Diamagnetism and Magne-Crystallic Action;" "On the Polarity of Bismuth, including an Examination of the Magnetic Field;" "On the Nature of the Force by which Bodies are repelled from the Poles of a Magnet;" "Further Researches on the Polarity of the Diamagnetic Force;" "On the Relation of Diamagnetic Polarity to Magne-Crystallic Action." The rest of the work consists of a number of letters, essays, and reviews relating to magnetism and electricity.

Dr. Tyndall's style is so simple, and his powers of elucidating difficult subjects are so consummate, that, as a matter of course, the work, as a whole, forms as clear an exposition of its subjects as it is probably possible to draw up; and we feel that the thanks of the scientific public are due to Professor Tyndall for its appearance.

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CORRESPONDENCE.

A SUBSCRIBER'S VALEDICTION.—*From* RICHARD A. PROCTOR, B.A., F.R.A.S.

SIR,—I believe I was the first to congratulate you when, a year and a half ago, you started SCIENTIFIC OPINION. Nor do I write now to condole with you; since we subscribers, and not you, are to be condoled with on the transfer of SCIENTIFIC OPINION. If Solon was right in saying no man was to be regarded as happy till the end had crowned his life, you should be congratulated in that SCIENTIFIC OPINION has been to the very last all that was promised in the beginning of its career. You have done a good work; and if, by unfair treatment, SCIENTIFIC OPINION has been caused to succumb, you may at least say this—that, *first*, you have shown your rival the road to success; and, *secondly*, that, if he has spoiled your progress, he has been unequal to the task of progressing himself, and is, in fact, in a quagmire. Further, you started without vain-glorious boasting or empty promises, and each number was an improvement on the last: your rival, quietly appropriating your plan, and loudly boasting what great things it would perform, has sunk to what it is.

A word as to the journal into which SCIENTIFIC OPINION is to be merged.

I believe a great career lies before the *English Mechanic*. It has long had an enormous circulation; and amongst its subscribers I could name many of the leading men of science of the day. But some time ago it was not doing so well as could be wished. Excellent letters from a Fellow of the Royal Astronomical Society, and other thoughtful students of science, were swamped by a number of silly articles and letters calculated to ruin the journal, despite the large array of its supporters. All this has now changed. Not suddenly, but with care and forethought, the whole tone of the publication has been modified. The natural result has followed. Men of science are no longer ashamed, as a year ago they might well be, to appear in the columns of this widely circulating journal. On the contrary, they feel that it supplies them with the opportunity of supplying useful information to an enormous circle of readers. And thus it has happened that, referring only to the subject in which I personally take chief interest, letters or papers have appeared, within the last two or three weeks alone, from such well-known astronomers as Webb, Penrose, Lockyer, and Birt; while "F. R. A. S." continues to supply his valuable contributions.

The *English Mechanic* deserves success by its pluck and energy, and by the care and skill with which (at least during the last few months) it has been conducted.

Yours very truly,

RICHARD A. PROCTOR.

GRIFFITH'S SYSTEM OF BOTANICAL ANALYSIS.—*From* W. HANDSEL GRIFFITHS.

SIR,—Will you permit me to direct the attention of the reviewer of the above work to one or two points in which, on due consideration, I think, he will allow himself to have been scarcely just.

1st. He is wholly unwarranted in his assumption that I am an advocate for the teaching of Systematic Botany *exclusively* by means of artificial analysis. I think, however, that everybody will agree with me in regarding artificial analysis, in our present state of knowledge, as a *valuable means of facilitating diagnosis*, and as being a *most useful aid to memory* in the case of students commencing the extensive study of Systematic Botany.

2nd. It is scarcely an act of justice on the part of the reviewer to suppress the fact that my readers are distinctly cautioned in my work against the error of supposing that the arrangement of the natural orders therein is in accordance with their natural affinities.

3rd. The reviewer is unjust in his endeavour to make it appear that the above objection is *peculiar* to my work, and in ascribing to me the *creation* of the difficulty. He cannot be ignorant of the fact that this objection is applicable, *in an equal degree*, to every work on artificial analysis which has been hitherto published (*not even excepting Bentham's Analytical Key*), and that no system of artificial analysis can be constructed which will be free from this drawback.

4th. The gravest injustice of all consists in the manner in which the reviewer cites examples of objectionable grouping of orders. He suppresses the fact that in each of the cases he refers to, *peculiar genera of the orders are specified*, and he culpably endeavours to lead his readers into the false impression that the orders he mentions have been grouped, as presenting general characters of similarity in *all* their members.

In conclusion, I have only to say that no one can be more sensible than I am of the many shortcomings and faults of my book; and that for any criticism of it, however adverse, *if only just*, I shall be most grateful.

I appeal to your sense of justice to publish this note, and am,

Sir, yours truly,

London, June 24. W. HANDSEL GRIFFITHS.

THE CORONA.—*From* RICHARD A. PROCTOR, B.A., F.R.A.S.

SIR,—Perhaps you will not object to insert this reply to a letter from Dr. Gould in last week's *Nature*. Nothing opposed to Mr. Lockyer's pet theory is likely to find a place in the journal he edits.

I do not think Dr. Gould's lucid account of his views could have been misunderstood. I, at least, who replied to him, understood him in the sense in which he has written to you.

The chief question at issue has been whether there is or not *anything at the sun* (to use Dr. Gould's expression, as, on account of its very vagueness, the most suitable) *outside the prominences*. Mr. Lockyer has said *no*; I and others have said *yes*; and Dr. Gould has helped to prove we were right. It had always seemed to me, however, that the photographs taken by Mr. De La Rue and Fr. Secchi in 1860 had settled the question.

The question relating to matter outside this brilliant appendage is of less moment. We know certainly that during totality, there is some light in our atmosphere, and the question where this begins or ends is more interesting to the meteorologist than to the astronomer. But I would invite Dr. Gould's attention to the fact that in the March number of the Astronomical Society's monthly notices I have given a simple mathematical proof of the fact that no atmospheric light *can* come in any considerable total eclipse from any region of the sky within seven or eight degrees of the eclipsed sun.

So far as this proof is concerned, I cannot admit that the matter is one of theory at all. But my views as to the *nature of the material* producing this coronal light are not founded on absolutely certain evidence, though the evidence in their favour is very strong indeed; moreover, I should expect that precisely those appearances would be seen which Dr. Gould regards as tending to show that the faint coronal light arises from something which *is not at the sun*.

But really, where a mathematical demonstration of a fact is extant, the consideration of arguments derived from admittedly doubtful evidence seems a mere waste of time. It may as readily be shown that the three angles of a triangle are not equal to two right angles, as that in the Indian or American eclipses atmospheric glare could have been visible within seven or eight degrees of the eclipsed sun.

In the supplementary number of the notices of the Astronomical Society I hope to give a further explanation of the extremely simple proof on which my views depend; and, because all questions involving considerations of predimensional space are perplexing to most non-mathematicians) I am having a mechanical figure constructed to render the matter clearer, in illustration of papers I hope to read at the next meeting of the British Association; and, next November, before the Astronomical Society. RICHARD A. PROCTOR.

The Thames and the Public Health.—The Select Committee on the Thames Navigation Bill, now before Parliament, have reported, that as the Metropolitan Board of Works has hitherto done nothing effectually to keep the sewage out of the Thames, "immediate attention should be given to the subject, in order that the sewage of the metropolis should be utilized as far as practicable." In the meantime, and until that can be accomplished, the Committee approve of the Thames Navigation Bill for preventing any obstruction to the navigation of the river from the outflow of sewage at Barking and Crossness.

FOREIGN ACADEMIES.

FRENCH ACADEMY.

LAST MEETING OF THE ACADEMY.—After the correspondence of the day had been brought forward by M. Elie de Beaumont, M. Edmond Becquerel presented a work by M. Cornu on "The Measurement of the Absolute Intensity of Terrestrial Magnetism;" and another memoir by M. Lucas and Cazin, on "The Duration of Electric Sparks." These experimentors made use of an arrangement already employed by M. Becquerel for measuring this duration of two transparent disks, one fixed, the other mobile, the motions of the movable disk being recorded by the other disk. He discovered, amongst other results, that the nature of the balls between which the discharge takes place has not any influence on the duration of the sparks.

M. Henri Sainte-Claire Deville presented a note by M. Ch. Schlœsing, showing that important results may be obtained by operating with precision on the simplest compounds.

M. Balard brought forward a work by Scheurer-Kestner, on the "marc" of soda, obtained by the Leblanc process. The author found it to contain seleniates, which is not astonishing, since the sulphuric acid employed was obtained from pyrites of Chessy, which contains selenium; it also contained sulpho-cyanide of sodium; lastly, he asserts that the loss of sodium in the industry, which amounts in all from 15 to 20 per cent., does not arise, as is believed, from the volatilisation of this metal.

M. Delaunay communicated, in the name of M. Rayet, an observation on the reversal of the two sodium lines in the spectrum of a solar protuberance. He adds that Mr. Lockyer, on his side, seems to have made the same assertion on February 28th last.

M. Delaunay also presented a note by M. Tarry on *pluies de poussière*, which are caused by cyclones, and reach France from the Sahara.

M. Wurtz communicated, in the name of M. Grimaux, the discovery of the first glycol of the aromatic series—tolylenic glycol. It is solid, crystallized; its reactions are well defined. Its acid, which is in the same relation to it as oxalic acid to the ordinary glycol, is nothing but terephthalic acid, formerly derived from the essence of turpentine.

M. Jamin presented a new communication on "The Phenomena of the Rise and Fall of the Temperature in the mixing of Liquids."

M. Bussy claimed priority for a paper brought forward by him on the same subject; thus it results that the fact pointed out in M. Jamin's communication is not new, although the merit of explaining it is his.

NOTES AND MEMORANDA.

Geologists' Association.—The excursion of the above Association to Folkestone on Saturday, the 18th June, although thinly attended, was, in its results, perhaps, one of the most successful of the present season. The beauty of the weather, enhanced by the delicious coolness of the sea-breezes; the fine state of the sections visited; and the abundance of the fossils, left nothing to be desired by those whose good fortune had again placed them under the guidance of Professor Morris. On arriving at the pier, a rapid survey was taken of the chief points of interest along the coast to right and left of Folkstone. The fine chalk cliffs forming the northern boundary of East-ware Bay, rising at Folkestone Hill to a height of 566 ft.; the outcrop of the soft clay beds of the Gault, and the consequent sudden depression and recedence of the coast line; the rise of the sands and stone-beds of the Neocomian strata from beneath Cape Point, and their continuance to and beyond the town of Folkestone, were all matters of remark; while the former existence and position of a gravel-bed, containing the remains of extinct mammalia—Elephas, Rhynoceras, &c.—on the high ground above the harbour, was noted. The first strata examined in detail were some dark-greenish semi-argillaceous sands, known as the "Sandgate beds," which rise on the shore at a short distance west of Folkestone. The low undercliff which skirts the shore from Folkestone nearly to Hythe, was shown to owe its origin to the presence of these beds, which, from their retention of water and slight coherency of structure, have caused the frequent subsidence of the beds above. These greenish beds were shown to contain sulphur, iron pyrites in minute grains, and a large proportion of silicate of iron. Unlike the sands above, they do not effervesce in acid. The sands and siliceous sandstones of the "Folkestone beds" above were next examined, and proved to be highly interesting. Sandy conglomerates, containing rounded fragments of quartz, white or grey, often stained to a greenish colour; fragments of quartzose, jasper, and flinty slate, mingled with small phosphatic nodules and casts of shells, were seen to alternate with soft marly beds, containing an abundance of fossils. The stone beds at a higher level, ranging upwards almost to the Gault, were shown by Prof. Morris to consist, in great measure, of the remains of sponges. This was best seen beneath the cliffs to the east of Folkestone; the huge slabs of stone just above tide-mark being in many places literally made up of sponges, exhibiting in the weathered cavities left by the decomposition of the more ramose varieties a perfect network of siliceous spiculæ. Sections showing the passage of the Neocomian sands into the Gault were next examined, the chief points observed being the gradual increase of argillaceous matter in the sands in approaching the Gault; the occurrence of a band of phosphatic nodules, associated with *Ammonites mammillaris*, at about three feet beneath the Gault; and the abundance of pyritized coniferous wood contained in the nodular phosphatic bed at the base of the Gault itself. Evidence of the constant slipping forward of the Gault over its own basement bed was in places very apparent. As the tide fell, the brilliantly-coloured fossils of the Gault became exposed to view upon the flat shore of the Bay, and many nice specimens were carried off. After a few words from Prof. Morris on the great influence of the geological structure of a country upon its physical features, so clearly seen in the country around Folkestone, a rough walk over the broken undercliff of the Gault, towards the station, terminated the day's proceedings.

New Work on Quantitative Analysis.—Professor H. Storer, the talented Professor of Chemistry, at the Institute of Technology, Massachusetts, is, says the *Chemical News*, engaged on a work on Quantitative Analysis, the first part of which will be ready in August. It is arranged in dictionary form, and will be one of the most complete and valuable works extant on analysis. The first sheet, which is now before us, treats of the Quantitative Estimation of Acetic Acid, Acetate of Aluminium, Acetate of Barium, Acetate of Iron, Acetate of Lead, Acetate of Sodium (or of Potassium), Acetate of Uranium, Aconitin, Albumin, Alcohol, together with Acidimetry and Alcoholometry. If all the subjects are treated as fully as those in the first sheet, as we have no doubt they will be, the work will be welcomed by all chemists.

A Civic Sanitary Staff.—The authorities of Glasgow, says the *Daily Express*, have at length the satisfaction of having organized the most complete "sanitary department" probably ever established as a permanent branch of administration in any of our British cities. The object aimed at is no less than to prevent disease—not only to wipe away the reproach which Glasgow has of late years been incurring from the mortality returns, but to render the town more clean and sweet to live in, to improve the habits and condition of the poor, and to secure more vigorous health and greater length of days to all. The "Sanitary Inspection Service" consists of a chief officer, five district inspectors, and thirty ordinary nuisance inspectors, each of whom has a section of one of the five districts into which the city has been divided under his charge.

SCIENTIFIC DIARY.

WEDNESDAY, June 29th.

Society of Arts, 8 p.m.

THURSDAY, 30th.

Philosophical Club, 6 p.m.

FRIDAY, July 1st.

Geologists' Association, 8 p.m.
Archæological Institute, 4 p.m.

SUNDAY, 3rd.

Sunday Lecture Society, 8 p.m. "On Man's Cruelty to Man," by Allen D. Graham, M.A.

MONDAY, 4th.

Entomological Society, 7 p.m.
London Institution, 4 p.m.
Asiatic Society, 3 p.m.

WEDNESDAY, 6th.

Obstetrical Society, 8 p.m.

SPECIAL NOTICE.

Subscribers, Correspondents, and the Publishing Trade generally, are requested to take note of the changes connected with this Journal which are about to take place next week, and which are explained at length in the "Publishers' Announcement" given in another page of the present Number.

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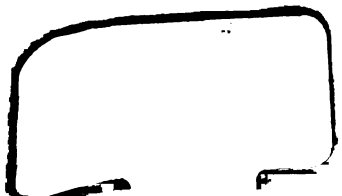
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